

**Wilderness Character Monitoring Report
Hyalite Porcupine Buffalo Horn
Wilderness Study Area**

U.S. Forest Service, Region 1
Gallatin National Forest



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EXECUTIVE SUMMARY

The Gallatin National Forest, in cooperation with the University of Montana, recently completed an updated wilderness character monitoring report for the Hyalite Porcupine Buffalo Horn Wilderness Study Area (HPBH WSA). The Forest has been engaged in documenting changes to wilderness character for over a decade, in preparation for revisions to the Gallatin National Forest Travel Management Plan. This report builds on Schlenker (2003) to better articulate baseline data describing wilderness character in the HPBH WSA.

Recent efforts to standardize wilderness character monitoring (e.g. Landres et al. 2005; Landres et al. 2008) have provided an improved structure and template for building wilderness character monitoring assessments. These efforts are guided by the 1964 Wilderness Act itself, using the statutory language of the Act to identify four qualities of wilderness: “untrammeled”, “natural”, “undeveloped” and “solitude or a primitive and unconfined type of recreation”. These four qualities, with associated indicators and measures, structured and informed the wilderness character monitoring efforts reported here for the HPBH WSA. Additionally, the Forest Service Northern Region recently provided an interpretation of “baseline” wilderness character measures appropriate for designated Wilderness in the Northern Region that are largely applicable to the Region’s WSAs as well. This interpretation was also used to identify measures and structure reporting for the HPBH WSA. The ultimate intent of this assessment is to employ standardized monitoring protocols for a set of measures that address each monitoring question and indicator, are easily replicated, and capitalize on readily available data from ongoing monitoring efforts across the Greater Yellowstone Area.

This report makes no attempt to characterize trend. Rather, this effort clearly establishes a “baseline” of wilderness conditions in the HPBH WSA as a snapshot in time. Historic data that mirrors this protocol is largely lacking for most elements, so trend assessments are not yet possible. Additionally, prior to assessing trend following the next round of monitoring, the Forest will need to establish what constitutes “significant change” thresholds, and assign weights for each measure that reflect local and regional importance. Table 3 in this report sets up the format for aggregating data following subsequent monitoring efforts. Please refer to Table 8 in *Keeping it Wild* (Landres et al. 2008) for an example of a populated wilderness character monitoring trend summary.

This monitoring effort makes no decisions, but rather is simply an aggregation of what was learned through on-the-ground monitoring efforts in 2011, combined with existing data relevant to the specific measures. This report provides a solid basis for documenting future changes in wilderness character across this landscape, and can help inform proposed managerial actions and quantify their impact on the wilderness character of the HPBH WSA.

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INTRODUCTION

BIOPHYSICAL BACKGROUND

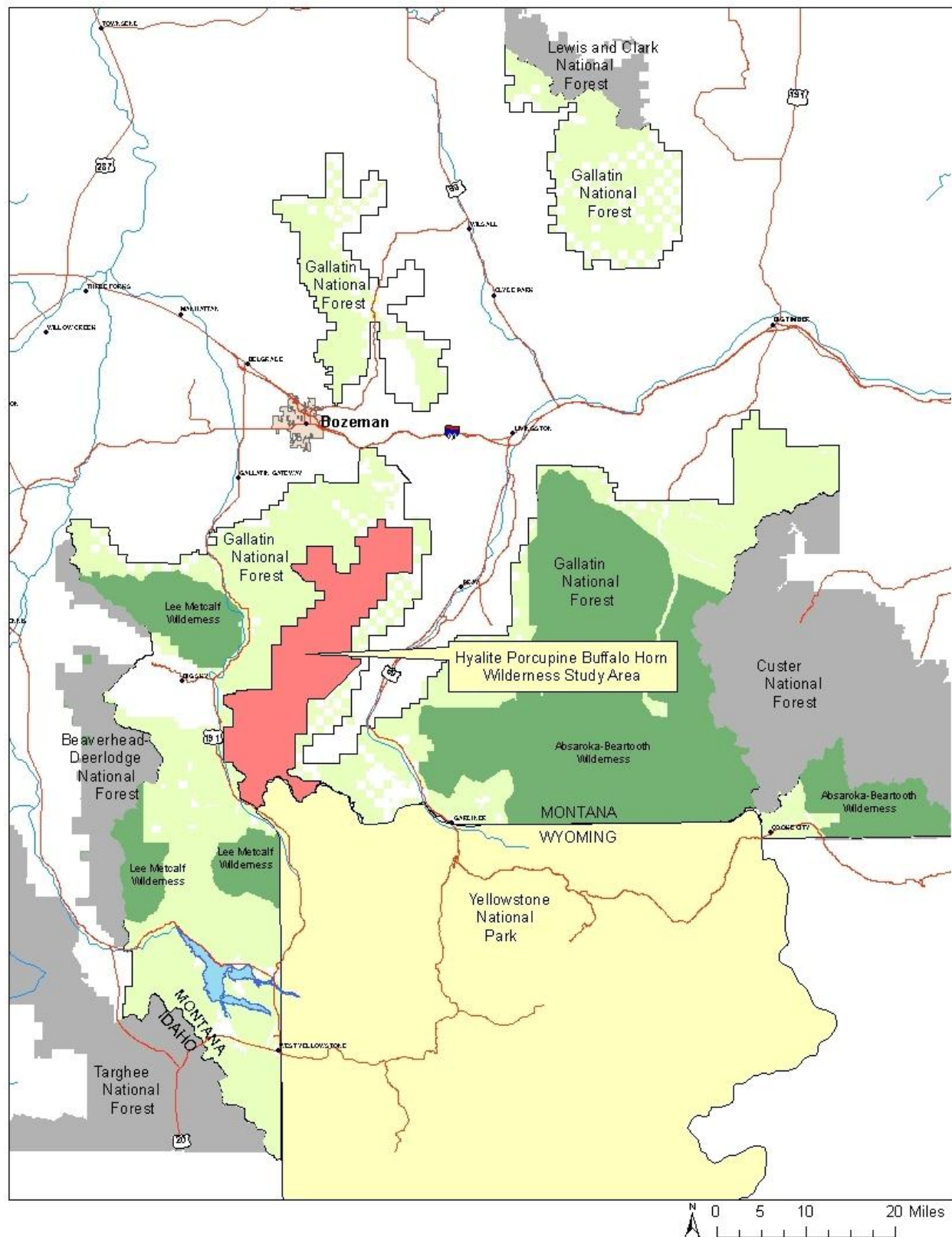
The Hyalite Porcupine Buffalo Horn (HPBH) Wilderness Study Area (WSA) is located on the Gallatin National Forest in south-central Montana. The HPBH WSA consists of approximately 155,000 acres of the northern Gallatin Range between the Gallatin and Yellowstone Rivers. It extends southward from the Hyalite Peaks area along the Gallatin crest to the northwestern corner of Yellowstone National Park. The HPBH WSA is approximately 36 miles in length and between four and 12 miles in width.

The HPBH WSA's topography is highly variable. The northern portion of the study area contains jagged peaks, U-shaped valleys, and cirque basins. A more moderate topography is found in the remainder of the WSA. Elevations range from approximately 5,500 feet to over 10,300 feet. Prominent peaks include Mount Blackmore, Mount Bole, Hyalite Peak, Eaglehead Mountain, and Fortress Mountain. Major streams include the headwaters of Hyalite, Bozeman, Trail, Eightmile, Big, Rock, Tom Miner, Buffalo Horn, Porcupine, Portal, Moose, Swan, Squaw, and South Cottonwood creeks. The City of Bozeman is dependent on the Bozeman and Hyalite drainages for municipal water, and the headwaters of both are partially contained within the HPBH WSA.

The HPBH WSA supports diverse vegetation communities. At the lowest elevations grasslands are found, which then transition into Douglas fir (*Pseudotsuga menziesii*) and/or limber pine (*Pinus flexilis*) stands. At higher elevations, lodgepole pine (*Pinus contorta*), spruce, and subalpine forests are found. The highest elevations contain whitebark pine (*Pinus albicaulis*) and, beyond the timberline, alpine tundra or alpine turf. Forested portions of the HPBH WSA are affected by mountain pine beetle epidemics, dwarf mistletoe, spruce budworm, and white pine blister rust. Riparian areas within the HPBH WSA support wetland vegetation and are influenced by high soil moisture. These areas are highly productive and provide protection against erosional forces.

The variety of HPBH WSA habitats provide for a wide range of wildlife species. Important species found within the WSA include bighorn sheep (*Ovis canadensis*), Rocky Mountain elk (*Cervus canadensis*), grizzly bear (*Ursus arctos horribilis*), moose (*Alces alces*), wolverine (*Gulo gulo*), Arctic grayling (*Thymallus arcticus*), westslope cutthroat trout (*Oncorhynchus clarkia lewisi*), Yellowstone cutthroat trout (*Oncorhynchus clarkia bouvieri*), and whitebark pine. The HPBH WSA falls within the purview of interagency efforts to manage and study grizzly bear and whitebark pine communities.

Figure 1. HPBH WSA location within the Greater Yellowstone Ecosystem



Vicinity Map
Hyalite Porcupine Buffalo Horn
Wilderness Study Area

HYALITE PORCUPINE BUFFALO HORN WILDERNESS STUDY AREA

Yellowstone National Park

SOCIOPOLITICAL BACKGROUND

Congress passed the Montana Wilderness Study Act (P.L. 95-150) in 1977, which included the HPBH, as well as eight other WSAs across Montana.

In 1977, approximately 50,000 - 56,000 acres within the HPBH WSA were privately owned.¹ These private lands were arranged in a checkerboard pattern across the WSA. Since then, the Forest Service has acquired over 37,000 acres of this private land, most of these previously owned by Burlington Northern Railroad and, subsequently, their timber subsidiary, Plum Creek Timber, Inc. The acquisition of these lands increased the number of public access points from nine to 16 trailheads (Schlenker 2003).

The 1985 Hyalite Porcupine Buffalo Horn Wilderness Study Report indicated that visitor uses primarily included hiking, camping, hunting, snowmobiling, motorcycle riding, horseback riding, collecting specimens from the Gallatin Petrified Forest, and cross-country skiing (USDA 1985). Big game hunting, trout and grayling fishing, and activities provided by outfitters, guides, and dude ranches were also popular. By 2003, HPBH WSA recreation uses had shifted, mirroring changes seen elsewhere on the Gallatin National Forest and in the Northern Rockies. Combined with population increases in Gallatin and Park Counties, this shift resulted in notable increases in mountain biking, motorcycle and ATV use, snowmobiling, and ice climbing (Schlenker 2003).

There have been a number of other significant changes in HPBH WSA use, rights, and facilities since 1977. There are no remaining active hard rock or leasable mineral claims, in comparison to the 24,342 acres of leases and claims present in 1977. Permitted livestock grazing has been reduced. Two range allotments have been waived back to the Forest Service and one has been rested since the Fridley fire in 2001. Across active allotments the number of permitted livestock has been reduced. Only two of three cabins present in 1977 remain. Snow survey sites have been reduced from four to two. No new trails have been constructed; only reconstruction or reroutes of failed existing trails have occurred and 1.5 miles of road was converted to trail via a restoration project. Six miles of road in the West Pine drainage were recontoured and reseeded. Many old logging roads have grown in with trees and ground cover, although satellite imagery (circa 2003) showed 34 miles of remaining, visible old road within the HPBH WSA.

Prior to 1977, timber harvest, associated road construction, and subsequent stand improvement activities took place on over 2,100 acres of private land within the HPBH WSA boundary. Timber harvest had also occurred on approximately 400 acres of federal land prior to 1971. These harvest activities were responsible for the construction of most of the roads that existed within the HPBH WSA at the time. Since 1977, timber management activities within the study area have all been associated with private land or restoration work on recently acquired land. All of these activities occurred on a total of 242 acres along the periphery of the HPBH WSA.

A number of management issues have subsided since 1977, while new issues have arisen. The acquisition of private land within the WSA has largely mitigated complications caused by the checkerboard pattern of land ownership present at the time of WSA establishment. Timber harvesting activities and associated road construction has largely ceased. Management must now address the growing presence and impacts of invasive species, as well as an increased number of threatened and endangered animal and plant species. New forms of recreation also have been introduced, with mountain biking and ice climbing, in particular, growing in popularity in the HPBH WSA (Schlenker 2003).

Since its establishment in 1977, the HPBH WSA's management and potential future designation as wilderness has been controversial. Discussion has often focused on management and use of motorized vehicles within the WSA, and has resulted in a series of court and litigation actions. In 1996, the Montana Wilderness Association initiated legislation over Forest Service Management of WSA's across Montana, citing loss of historic wilderness character

¹ The 1985 Hyalite Porcupine Buffalo Horn Wilderness Study Report identified approximately 49,300 acres of private land. The 1977 Gallatin NF Forest Travel Plan Map identified over 56,000 acres of private land. It is unknown which is correct.

due to increased motorized recreation and lack of appropriate management actions by the Agency. This lawsuit specifically cited the HPBH WSA and concerns about Gallatin National Forest management actions. The litigation was settled in 2001 and resulted in the Forest Service's agreement to conduct travel management planning for all WSAs.

In 2006, the Gallatin National Forest published its Record of Decision for the Final Travel Management Plan. The Decision established summer and winter travel management direction across the entire Gallatin Forest, including the HPBH WSA. This Decision received 113 appeals in 2007 and was subsequently upheld by the Regional Forester. In response, Citizens for Balanced Use (CBU) filed suit on the Travel Plan in its entirety, and the Montana Wilderness Association, Greater Yellowstone Coalition, and The Wilderness Society challenged the WSA's management direction. All complaints were joined and addressed in District Court. The court ruled on these complaints in September 2009, upholding the Travel Plan Decision in all areas other than the HPBH WSA. Within the WSA, the travel decision was enjoined, and in its place the Gallatin National Forest implemented interim summer and winter travel orders further restricting mechanized and motorized travel within the HPBH WSA (Table 1). This winter interim order was promptly challenged in District Court by CBU. Shortly after the 2009 District Court ruling, the Forest Service and CBU appealed the District Court Decision to the 9th Circuit Court. In December 2011, the 9th Circuit Court ruled that the 2006 Travel Plan Decision within the HPBH WSA did not adequately protect wilderness character. On June 25, 2012, District Court Judge Haddon found that CBU's subsequent suit had been "squarely resolved" by the 9th decision in the case of Russell Country Sportsmen v. United States Forest Service and granted the defendants motion for summary judgment.

In summary, since the first Congressional hearings in 1975 proposing the HPBH as a WSA, management of this area has been controversial. Undoubtedly, controversy will remain a reality of management until a new land allocation decision is made. A number of Gallatin National Forest actions taken since 1977, however, have improved or restored wilderness character in the HPBH WSA, including the acquisition of private land, reduction in number of developments, and the enactment and revision of travel plans.

Table 1. Summary of travel management, 1977 to 2011

	1977 Mileage	Pre-2006 Travel Plan Decision Mileage	2006 Travel Plan Decision Mileage	Interim Travel Plan Orders Mileage – 2011/2012
<i>All trails</i>	205	205	208	208
<i>Open to motorcycles, mountain bikes, foot, and stock</i>	188 *	136	68	39
<i>Open to mountain bikes, foot, and stock (not motorcycles)</i>	205	205	100	21
<i>Foot and stock use only</i>	17	0	37	148
<i>Timeshare trails</i>	0	0	±15	±15
<i>Miles of snowmobile trail **</i>	12	12	12	12
<i>Approximate open snowmobile area</i>	136,000 acres	112,000 acres	11,000 acres	2,666 acres

* While trails were legally open to mountain bikes in 1977, they were not likely present.

** This mileage represents the Big Sky Snowmobile Trail running north to south from Portal Creek exiting at Buffalo Horn Creek, the only official sanctioned snowmobile trail in the WSA since 1977.

WILDERNESS CHARACTER BACKGROUND

The Wilderness Act of 1964 mandates the preservation of wilderness character in congressionally designated wilderness. The *Congressional Record* (United States Congress 1983) reinforces this mandate, stating, “The overriding principle guiding management of all wilderness areas, regardless of which agency administers them, is the Wilderness Act (section 4(b)) mandate to preserve their wilderness character.” Wilderness character is not explicitly defined in The Wilderness Act of 1964, but congressional intent is expressed in the Definition of Wilderness, Section 2c of the Wilderness Act:

A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, education, scenic, or historical value.

In 2005, a Forest Service Wilderness Monitoring Committee applied this definition in order to identify four tangible qualities of wilderness relevant and practical to wilderness stewardship: untrammelled, natural, undeveloped, and opportunities for solitude or a primitive and unconfined type of recreation. Together, these qualities provided the foundation for the development of the Forest Service’s national framework (Landres et al. 2005) and Technical Guide (Landres et al. 2009) for wilderness character monitoring. The Technical Guide indicates that wilderness character monitoring is “needed to fulfill legal and policy mandates, improve stewardship and accountability; and improve communication among managers, decision makers, policymakers, and the public.”

A FRAMEWORK FOR MONITORING WILDERNESS CHARACTER

In 2006, the Interagency Wilderness Character Monitoring Team, with representatives from the Bureau of Land Management, U.S. Fish & Wildlife Service, National Park Service, U.S. Geological Survey, and the U.S. Forest Service, was formed to develop an interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System. This team released *Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System* (Landres et al. 2008; hereafter *Keeping It Wild*). *Keeping It Wild* outlines a robust framework for wilderness character monitoring and provided the foundation for developing the wilderness character monitoring measures presented in this report.

Keeping It Wild defines four qualities of wilderness character that mirror the 2005 Forest Service national framework: untrammelled, natural, undeveloped, and solitude or a primitive and unconfined type of recreation. The *Keeping It Wild* framework requires each of these qualities to be described in greater detail by two or more indicators. Thirteen defined indicators provide the framework within which each wilderness identifies at least one locally relevant measure for each indicator. Indicators were chosen to be relevant, reliable, and cost effective, and *Keeping It Wild* encourages wilderness managers to select measures that also fulfill these criteria. This approach allows for national consistency (imposed by the 13 universally used indicators) while maintaining local flexibility—as each wilderness can develop place-specific measures and relevant monitoring protocols. *Keeping It Wild* also provides a framework for evaluating trends in wilderness character, based on five-year assessments of changes across the implemented monitoring measures.

FOREST SERVICE REGION 1 INTERPRETATION OF MINIMUM PROTOCOL

In the fall of 2011, Northern Region Wilderness Program Manager, Chris Ryan, worked with Peter Landres and a complement of resource specialists to distill a “minimum protocol” for wilderness character monitoring in the Northern Region based on *Keeping It Wild*. After several interdisciplinary team meetings and feedback from the Region’s wilderness managers, a minimum protocol with measures appropriate for all wildernesses in the region was developed. The Region 1 minimum protocol was used as a basis for developing the indicators and measures for the HPBH WSA (see Appendix A). This protocol will also be piloted in the Selway Bitterroot Wilderness during the 2012 field season.

WILDERNESS CHARACTER MONITORING IN WILDERNESS STUDY AREAS (WSAs)

The Montana Wilderness Study Act of 1977 specified that, “subject to existing private rights, the wilderness study areas designated by this Act shall, until Congress determines otherwise, be administered by the Secretary of Agriculture so as to maintain their presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System” (Public Law 95-150). Thereby, the mandates of this act are served by the implementation of wilderness character monitoring in wilderness study areas, such as the Hyalite Porcupine Buffalo Horn Wilderness Study Area on the Gallatin National Forest.

The implementation of wilderness character monitoring for WSAs is, in most instances, indistinct from the implementation of wilderness character monitoring for designated wilderness. Unlike designated wilderness, however, WSAs may still permit some activities and uses that are precluded from designated wilderness (as long as these activities do not degrade wilderness character as it is known to have existed in 1977, per the Montana Wilderness Study Act of 1977). The measures implemented for the Hyalite Porcupine Buffalo Horn Wilderness Study Area, as reflected in this report, take into account allowed activities and uses of the HPBH WSA as of 2011.

REPORT BACKGROUND

This report summarizes all HPBH WSA wilderness character monitoring measures selected for implementation. In November 2011, Gallatin National Forest wilderness and resource specialists and staff from the University of Montana Wilderness Institute (see contributors, below) convened to identify possible measures. Proposed measures were subsequently cross-walked with emerging regional protocols, and available data compiled. Within this report, we also include measures that were considered, but not chosen for implementation, as well as thorough references to supporting documentation and data sources.

This report is organized by the four wilderness qualities and thirteen wilderness character indicators defined in the *Keeping It Wild* framework, summarized, along with all HPBH WSA measures, in Table 2. For each implemented measure, this report provides the following information:

- **Definition:** What each measure will monitor, with basic information about how monitoring will be quantified (when necessary).
- **Context:** Relevant biophysical, historical, and sociopolitical information, including description of law or policy related to the measure, historical information, and information about the Greater Yellowstone Ecosystem.

- **Relevance:** How this measure relates to the wilderness quality and wilderness character monitoring indicator, including a simple explanation of how to interpret data (ex. 'A decrease in data values for this measure indicates a degradation of the natural quality of wilderness character.').
- **Data Source:** How data was derived for this measure, including contributors, database, and specialist reports. Provides basic information about how data was interpreted, summarized, and/or isolated.
- **Data Adequacy:** A description of known data and sampling method shortcomings and reliability.
- **Recent Trend(s):** Description of trends in previously collected data, if available; generally restricted to trends observed in the past decade (2000-2010).
- **2011 Baseline:** Wilderness character monitoring was not in place when the HPBH WSA was designated in 1977 and historical data is often insufficient to establish baselines for desired measures. This report summarizes data available in 2011 that can act as a baseline for monitoring wilderness character in the HPBH WSA going forward. In most cases, a single numerical value is provided to establish the baseline for each measure, but in some instances qualitative descriptions, numerical ranges, or multiple data points may serve as the measure baseline.
- **Significant Change:** Establishes a minimum fluctuation in measure data considered a significant change in wilderness character (either improving or degrading character; if this minimum fluctuation is not reached the wilderness character will be considered stable). Change is assessed from one monitoring period to the next and not across multiple monitoring periods. Ideally, significant change values will be developed at the landscape or Region 1 level, and not at the level of individual WSAs.
- **Monitoring Frequency:** Establishes a target interval (number of years) between measure reports. Intervals were established through consultation with experts, review of existing protocols, consideration of recommendations in *Keeping It Wild*, and input from managers. If data is collected on a more frequent cycle it will be summarized and reported based on the monitoring interval established by this section.
- **References:** Documentation and contacts that contributed to the development, data collection, and data analysis for each measure.

REPORT CONTRIBUTORS

This report was compiled in 2012 and relied on the input of many subject area experts. Overall guidance and development of the report was provided by Kimberly Schlenker, Gallatin National Forest Wilderness and Recreation Program Manager, and Catherine Filardi, Citizen Science Program Director, University of Montana Wilderness Institute.

The report draws heavily from the University of Montana Wilderness Institute's 2011 efforts collecting field data relevant to wilderness character. This effort stemmed from a 2009 collaboration between the Wilderness Institute, the Aldo Leopold Wilderness Research Institute, the Forest Service, and several local, non-governmental organizations to develop measurable field indicators for the four qualities of wilderness character identified in the Wilderness Act of 1964. In 2009 and 2010, Wilderness Institute crews implemented these field protocols across four of Montana's congressionally designated Wilderness Study Areas. During summer 2011, Wilderness Institute crews and community volunteers hiked every trail in the HPBH WSA and made detailed observations along 218 miles of system trails and 44 miles of non-system trails. The 'Data Source' and 'References' descriptions for each implemented measure indicate contributions by Wilderness Institute crews (see Noson and Filardi 2011, for additional background and detail on Wilderness Institute field measures).

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SUMMARY OF HPBH WSA WILDERNESS CHARACTER MONITORING MEASURES

Table 2. Summary of all implemented HPBH WSA wilderness character monitoring measures

Quality	Monitoring Question	Indicator	Measure
Untrammeled	What are the trends in actions that control or manipulate the “earth and its community of life” inside this WSA?	Actions authorized by the Federal land manager that manipulate the biophysical environment	Acres with noxious weed mitigation actions
			Acres of vegetation planted
			% of naturally ignited wildfires that receive a suppression response
			Acres of prescribed fire
			# of lakes and other waterbodies stocked with fish
		Actions not authorized by the Federal land manager that manipulate the biophysical environment	No measures implemented.
Natural	What are the trends in terrestrial, aquatic, and atmospheric natural resources inside this WSA?	Plant and animal species and communities	# of indigenous species listed as threatened, endangered, sensitive, or of concern
			% of monitored whitebark pine with evidence of mountain pine beetle
			% of monitored whitebark pine with evidence of blister rust
			Average # of whitebark pine seedlings per monitored site
			# of non-indigenous, non-plant species
			Abundance and distribution of indigenous and non-indigenous aquatic species
			% of area occupied by non-indigenous, invasive plant species
			Acres of grazing allotments with authorized use
			# of invasive plant species
		Physical resources	Average deciview
			Average sum of anthropogenic fine nitrate and sulfate
			Concentration of sulfur in wet deposition
			Concentration of nitrogen in wet deposition
			Extent and magnitude of

			human-caused stream bank erosion
			Assessment of overall stream quality
	What are the trends in terrestrial, aquatic, and atmospheric natural processes inside this WSA?	Biophysical processes	% of WSA in fire regime condition class two or three
Undeveloped	What are the trends in non-recreational development inside this WSA?	Non-recreational structures, installations, and developments	# of authorized non-recreational physical installations and developments
			# of unauthorized non-recreational physical installations and developments
		Inholdings	Acres of inholdings
	What are the trends in mechanization inside this WSA?	Use of motor vehicles, motorized equipment, or mechanical transport	Number of trail segments with evidence of unauthorized motorized or mechanized vehicle use
	What are the trends in cultural resources inside this WSA?	Loss of statutorily protected cultural resources	No measures implemented.
Opportunities for solitude or a primitive and unconfined type of recreation	What are the trends in outstanding opportunities for solitude inside this WSA?	Remoteness from sights and sounds of people inside the wilderness	Total estimated site visits
			Proportion of trail contacts in high use corridors
			Campsite index
			Acres affected by travel or access routes within the area
		Remoteness from occupied and modified areas outside the wilderness	Acres within area affected by travel routes outside area
	What are the trends in outstanding opportunities for primitive and unconfined recreation inside this WSA?	Facilities that decrease self-reliant recreation	# of agency-provided recreational facilities and developments
			# of user-created recreation facilities
			Trail miles in developed condition classes 3 to 5
			# of outfitter and guide assigned sites
		Management restrictions on visitor behavior	Trail miles / acres with restricted use
			# of additional management restrictions

SUMMARY OF HPBH WSA WILDERNESS CHARACTER MONITORING TRENDS

Following proposed guidelines (Landres et al. 2008), every five years wilderness character monitoring data for the HPBH WSA will be compiled into a trend summary by measure, indicator, question, and quality. Starting in 2016, these trends will expose patterns of change in wilderness character for the HPBH WSA (degrading, improving, or stable; see Landres et al. 2008). To assess trend by indicator, significant change thresholds must be established. Ideally, these thresholds will stem from broader regional (or beyond) efforts to standardize wilderness character monitoring. Because regional wilderness character monitoring efforts have not yet specifically addressed significant change thresholds, and because application of these thresholds is not relevant to the HPBH until the next round of monitoring (2016), this report does not attempt to establish thresholds. Furthermore, for trend analyses, each measure needs to be assigned weights that reflect local importance of specific measures; prior to 2016 monitoring, weights will need to be determined by Gallatin National Forest staff in consultation with standardized regional efforts.

Table 3 provides a proposed format to capture trend information and would be an expected product of wilderness character monitoring data reviews at five year intervals (starting in 2016 for the HPBH). Please refer to Table 8 in *Keeping It Wild* (Landres et al. 2008) for an example of a populated wilderness character monitoring trend summary table.

Table 3. Wilderness character trend summary framework for the HPBH WSA

Monitoring Question	Indicator	Measure	Trend in measure	Trend in indicator	Trend in question	Trend in quality	Trend in wilderness character
Untrammeled quality:							
What are the trends in actions that control or manipulate the “earth and its community of life” inside this WSA?	Actions authorized by the Federal land manager that manipulate the biophysical environment	Acres with noxious weed mitigation actions					
		Acres of vegetation planted					
		Percent of naturally ignited wildfires that receive a suppression response					
		Acres of prescribed fire					
		Number of lakes and other waterbodies stocked with fish					
Actions authorized by the Federal land manager that manipulate the biophysical environment	No measures selected for the HPBH WSA						

Monitoring Question	Indicator	Measure	Trend in measure	Trend in indicator	Trend in question	Trend in quality	Trend in wilderness character
Natural quality:							
What are the trends in terrestrial, aquatic, and atmospheric natural resources inside this WSA?	Plant and animal species and communities	Number of indigenous species listed as threatened, endangered, sensitive, or of concern					
		Percentage of monitored whitebark pine with evidence of mountain pine beetle					
		Percentage of monitored whitebark pine with evidence of blister rust					
		Average number of whitebark pine seedlings per monitored site					
		Number of non-indigenous, non-plant species					
		Abundance and distribution of indigenous and non-indigenous aquatic species					
		Percent of area occupied by non-indigenous, invasive plant species					
		Acres of grazing allotments with authorized use					
		Number of invasive plant species					
	Physical resources	Average deciview					
		Average sum of anthropogenic fine nitrate and sulfate					
		Concentration of sulfur in wet deposition					
		Concentration of nitrogen in wet deposition					
		Extent and magnitude of human-caused stream bank erosion					
		Assessment of overall stream quality					

Monitoring Question	Indicator	Measure	Trend in measure	Trend in indicator	Trend in question	Trend in quality	Trend in wilderness character
What are the trends in terrestrial, aquatic, and atmospheric natural processes inside this WSA?	Biophysical processes	Percentage of WSA in fire regime condition class two or three					
Undeveloped quality:							
What are the trends in non-recreational development inside this WSA?	Non-recreational structures, installations, and developments	Number of authorized non-recreational physical installations and developments					
		Number of unauthorized non-recreational physical installations and developments					
	Inholdings	Acres of inholdings					
What are the trends in mechanization inside this WSA?	Use of motor vehicles, motorized equipment, or mechanical transport	Number of trail segments with evidence of unauthorized motorized or mechanized vehicle use					
What are the trends in cultural resources inside this WSA?	Loss of statutorily protected cultural resources	No measures selected for the HPBH WSA					
Solitude or primitive and unconfined quality:							
What are the trends in outstanding opportunities for solitude inside this WSA?	Remoteness from sights and sounds of people inside the WSA	Total estimated site visits					
		Proportion of trail contacts in high use corridors					
		Campsite index					
		Acres affected by travel or access routes					
	Remoteness from occupied and modified areas outside the WSA	Acres within affected by travel routes outside area					

Monitoring Question	Indicator	Measure	Trend in measure	Trend in indicator	Trend in question	Trend in quality	Trend in wilderness character
What are the trends in outstanding opportunities for primitive and unconfined recreation inside this WSA?	Facilities that decrease self-reliant recreation	Number of agency-provided recreational facilities and developments					
		Number of user-created recreation facilities					
		Trail miles in developed condition classes 3 to 5					
		Number of outfitter and guide assigned sites					
	Management restrictions on visitor behavior	Trail miles / acres with restricted use					
		Number of additional management restrictions					

WILDERNESS CHARACTER MONITORING MEASURES

NATURAL QUALITY

The Wilderness Act states that wilderness is “protected and managed so as to preserve its natural conditions.” In short, wilderness ecological systems are substantially free from the effects of modern civilization. The natural quality of wilderness character in designated wilderness or WSAs is degraded by intended or unintended effects of modern people on the ecological systems inside the wilderness area.

Monitoring Question: What are the trends in terrestrial, aquatic, and atmospheric natural resources inside this WSA?

<i>Indicator</i>	<i>Species & Communities</i>
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MEASURE 1-1	NUMBER OF INDIGENOUS SPECIES LISTED AS THREATENED, ENDANGERED, SENSITIVE, OR OF CONCERN
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Definition	The number of indigenous species federally-listed as threatened, endangered, sensitive, or of concern, identified by the Regional Forester’s Office and known or assumed to utilize habitat within the HPBH WSA.
Context	<p>The U.S. Fish & Wildlife Service administers the federal threatened and endangered species program on behalf of all agencies.</p> <p>The Regional Forester’s Office provides a list of sensitive and species of concern. This should not be confused with the ‘Species of Concern’ list that is maintained by the Montana Natural Heritage Program and Montana Fish, Wildlife, and Parks.</p>
Relevance	These species have been identified because they are at risk. Species may be at risk for a number of reasons (habitat degradation, changing climate, disease, predator pressure, etc.). As the number of indigenous species identified as at risk increases, the natural quality of wilderness is degraded.
Data Source	All federally listed threatened, endangered, and proposed species are listed here: http://ecos.fws.gov/tess_public/pub/adHocSpeciesForm.jsp . A list of sensitive species and species of concern was obtained from the Regional Forester’s Office. Data was also supplied by Kristi Swisher, Region 1 Threatened and Endangered Species Biologist.
Data Adequacy	Professional knowledge has been used to determine whether a threatened, endangered, sensitive, or species of concern is known or likely to utilize habitat within the HPBH WSA. Although scientific studies or monitoring surveys have confirmed presence of many of these species in the HPBH WSA, this level of rigor has not been used to confirm the presence of all.
Recent trend(s)	In 2007, grizzly bears (<i>Ursus arctos horribilis</i>) and bald eagles (<i>Haliaeetus leucocephalus</i>) were delisted as endangered species. Also in 2007, northern goshawk (<i>Accipiter gentilis</i>) was removed from the sensitive species list for the region.

In 2009, grizzly bears were relisted. In the last several years, wolverine (*Gulo gulo*) and whitebark pine (*Pinus albicaulis*) have become candidate threatened or endangered species.

The addition of species to this list is not an indicator of specifically declining populations within the HPBH WSA, but instead reflects the level of threat the species is subjected to across its range.

2011 Baseline In 2011, one new sensitive species was recognized for the region: bighorn sheep (*Ovis canadensis*). This brings the total to 31 known indigenous species that are listed as threatened, endangered, sensitive, or species of concern known or assumed to utilize habitat within the HPBH WSA, or, in the case of plants, known or suspected to be established on the Gallatin National Forest.

Table 4. Threatened, endangered, sensitive, or species of concern, 2011

Common Name	Scientific Name	Status
Birds and mammals		
Bald eagle	<i>Haliaeetus leucocephalus</i>	Sensitive/species of concern
Bighorn sheep	<i>Ovis canadensis</i>	Sensitive/species of concern
Black-backed woodpecker	<i>Picoides arcticus</i>	Sensitive/species of concern
Canada lynx	<i>Lynx canadensis</i>	Threatened (likely habitat)
Gray wolf	<i>Canis lupus</i>	Sensitive/species of concern
Grizzly bear	<i>Ursus arctos horribilis</i>	Threatened
Peregrine falcon	<i>Falco peregrinus</i>	Sensitive/species of concern
Western big eared bat	<i>Corynorhinus townsendii</i>	Sensitive/species of concern
Wolverine	<i>Gulo gulo</i>	Sensitive/species of concern
Plants		
Alpine meadowrue	<i>Thalictrum alpinum</i>	Sensitive/species of concern
Austin's knotweed	<i>Polygonum douglasii</i>	Sensitive/species of concern
Barratt's willow	<i>Salix barrattiana</i>	Sensitive/species of concern
Beaked spikerush	<i>Eleocharis rostellata</i>	Sensitive/species of concern
California false helleborine	<i>Veratrum californicum</i>	Sensitive/species of concern
Discoid goldenweed var. macronema	<i>Haplopappus macronema</i>	Sensitive/species of concern
Dwarf purple monkey flower	<i>Mimulus nanus</i>	Sensitive/species of concern
English sundew	<i>Drosera anglica</i>	Sensitive/species of concern
Giant helleborine	<i>Epipactis gigantea</i>	Sensitive/species of concern
Hall's rush	<i>Juncus hallii</i>	Sensitive/species of concern
Hiker's gentian	<i>Gentianopsis simplex</i>	Sensitive/species of concern
Large leaved balsamroot	<i>Balsamorhiza macrophylla</i>	Sensitive/species of concern
Musk root	<i>Adoxa moschatellina</i>	Sensitive/species of concern
Northern rattlesnake plantain	<i>Goodyera repens</i>	Sensitive/species of concern
Shoshonea	<i>Shoshonea pulvinata</i>	Sensitive/species of concern
Slender cottongrass	<i>Eriophorum gracile</i>	Sensitive/species of concern
Small flowered columbine	<i>Aquilegia brevistyla</i>	Sensitive/species of concern
Small yellow lady's slipper	<i>Cypripedium parviflorum</i>	Sensitive/species of concern

Whitebark pine	<i>Pinus albicaulis</i>	Threatened (candidate), Sensitive/species of concern
Aquatic species		
Western pearshell mussel	<i>Margaritifera falcata</i>	Sensitive/species of concern
Westslope cutthroat trout	<i>Oncorhynchus clarkii lewisi</i>	Sensitive/species of concern
Yellowstone cutthroat trout	<i>Oncorhynchus clarkii bouvieri</i>	Sensitive/species of concern

Significant Change TBD

Monitoring Frequency Every five years

References Regional Forester's Sensitive Species List – Forest Service Region 1.

Whitebark Pine Background (Measures 1-2, 1-3, 1-4)

Measures 1-2, 1-3, and 1-4 address monitoring of whitebark pine health within the HPBH WSA. Whitebark pine (*Pinus albicaulis*) occurs in the subalpine zone of the Pacific Northwest and northern Rocky Mountains, where it is adapted to a harsh environment with poor soils, steep slopes, high winds, and extreme cold temperatures. In addition, its occurrence on wind-swept ridges plays an important role in snow accumulation, although one of its most critical ecosystem roles is as a food source for a variety of wildlife species.

Since 2004, interagency monitoring personnel have tagged and surveyed 587 whitebark pine trees taller than 1.4 meters at breast height within fifteen 10-meter by 50-meter monitoring sites within the HPBH WSA. These monitoring sites and trees are part of a Greater Yellowstone Ecosystem-wide sample of 5000+ whitebark pine trees in 150 pure and mixed whitebark pine stands selected at random from 10,700 stands throughout the Greater Yellowstone Ecosystem (Greater Yellowstone Ecosystem Interagency Whitebark Pine Monitoring Protocol). Monitoring these trees over the long term will provide status and trend estimates of the whitebark pine population in the Greater Yellowstone Ecosystem. Information collected from the tagged trees within the 15 monitoring sites located in the HPBH WSA is not intended or designed to represent the condition or status of all whitebark pine trees in the HPBH WSA.

MEASURE 1-2 PERCENTAGE OF MONITORED WHITEBARK PINE WITH EVIDENCE OF MOUNTAIN PINE BEETLE

Definition	Percentage of trees that have died since the last monitoring period that show evidence of mountain pine beetle (MPB) infestation.
Context	The mountain pine beetle (<i>Dendroctonus ponderosae</i>) is a native insect that has co-evolved with pine forests in the western United States. MPB represents a native threat to Greater Yellowstone Ecosystem whitebark pine populations. Research has demonstrated that milder winters and increasing average seasonal temperatures, attributed to global climate change, have increased the frequency, severity, and extent of MPB impacts (Carroll et al. 2003).
Data Source	Data are supplied by the Greater Yellowstone Ecosystem Interagency Whitebark Pine Monitoring Program. This program monitors 587 whitebark pine trees, as of 2011, within the HPBH WSA. Monitoring sites were originally established between 2004 and 2007. Since 2008, monitoring sites

within the HPBH WSA have been surveyed every other year to observe and record trees with MPB evidence. Not all 15 sites within the HPBH WSA are surveyed every sampling year. Each of the 15 sites are randomly assigned to one of four sample panels across the Greater Yellowstone Ecosystem. Sites are visited according to their panel membership. Every two years all four panels are sampled and all 15 monitoring sites within the HPBH WSA are visited to measure tree status (live or dead) and to check for evidence of MPB. In the future, sampling frequencies may change to a four-, instead of a two-, year sampling cycle.

The number of monitored trees that were living during the period for which data were last compiled for this monitoring measure should be utilized to calculate the percentage of monitored whitebark pine with evidence of MPB. For example, at the end of surveys used to create the 2011 baseline for this measure there were 484 living whitebark pine trees across the 15 HPBH WSA monitoring sites.

Data Adequacy The 587 trees monitored for this measure may or may not represent whitebark pine conditions or trends within the HPBH WSA. Review of the data by a statistician would be necessary to establish the confidence with which these samples represent the larger WSA whitebark pine landscape. Data are not available for monitoring sites prior to 2004. The first sample cycle for this measure is represented by the data collected between 2004 and 2011.

Recent Trend(s) While just four of 15 monitoring sites had one or more whitebark pine trees with observed MPB evidence during 2004-2007 surveys, all but three sites had trees with MPB evidence on subsequent surveys from 2008-2011 (See Figure 4).

Two of the sites surveyed between 2007 and 2009 in which one or more trees were observed with MPB evidence, did not exhibit any new evidence when surveyed again in 2010 and 2011. The other ten sites had at least one additional tree with observed MPB evidence.

2011 Baseline 14% of living trees in the 15 monitoring sites surveyed between 2004 and 2011 had evidence of MPB activity. 52% of these MPB infested trees were still alive when last surveyed. In addition, 7% of all surveyed trees died with evidence of MPB activity between 2004 and 2011 without MPB evidence being recorded while the trees were living. This is not necessarily an indication that the tree died from MPB, since many other mortality factors may have played a role, but the rapidity with which these trees died between survey visits is notable.

During the 2004 to 2011 period, a total of 20% of surveyed whitebark pine trees, both living and dead, demonstrated evidence of MPB activity (Figure 4; Rob Daley, personal communication).

Relevance This measure is climate change sensitive due to the connection between mountain pine beetles and climate warming (Carroll et al. 2003).

In 2011, the U.S. Fish & Wildlife Service granted whitebark pine warranted but precluded status as a threatened or endangered species. Whitebark pine is a keystone species within the Greater Yellowstone Ecosystem. Its seed is a critical food source for grizzly bears, red squirrels, and Clark's nutcracker. Whitebark pine mortality rates are increasing due to a number of factors. MPB attacks are a significant contributor (Keane and Arno 1993).

Significant Change TBD

Monitoring Frequency This measure will be evaluated every four years in order to ensure a complete survey cycle of each of the 15 sites within the HPBH WSA, given possible fluctuations in funding availability and project prioritization.

- References Carroll, A.; Taylor, S.; Regniere, J.; Safranyik, L. 2003. Effect of climate change on range expansion by the mountain pine beetle in British Columbia. The Bark Beetles, Fuels, and Fire Bibliography. Paper 195.
- Keane, R.; Arno, S. 1993. Rapid decline of whitebark pine in western Montana: evidence from 20-year remeasurements. Western Journal of Applied Forestry. 8(2): 44-47.
- Greater Yellowstone Network Whitebark Pine Monitoring Working Group. 2011. Interagency Whitebark Pine Monitoring Protocol for the Greater Yellowstone Ecosystem, Version 1.1. Greater Yellowstone Coordinating Committee, Bozeman, MT.
- Greater Yellowstone Network Whitebark Pine Monitoring Working Group. 2012. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2011 annual report. Natural Resource Data Series NPS/GRYN/NRDS—2012/278. National Park Service, Fort Collins, Colorado. (<http://www.greateryellowstonescience.org/subproducts/14/7>)

MEASURE 1-3 PERCENTAGE OF MONITORED WHITEBARK PINE WITH EVIDENCE OF WHITE PINE BLISTER RUST

- Definition Percentage of trees that have died since the last monitoring period that show evidence of white pine blister rust.
- Context Whitebark pine stands have been significantly reduced in areas of the Cascades and northern Rocky Mountains due to the introduction of the introduced pathogen white pine blister rust (*Cronartium ribicola*). This fungus enters the stomata of whitebark pine needles and then erupts into cankers on the branches, leading to a cessation of cone production and, in some cases, the eventual death of the tree (Tomback et al. 2001). Infection by blister rust also weakens the tree and can lead to death by an accumulation of factors, including mountain pine beetle, other pathogens, root diseases, and unfavorable climatic conditions (Koteen 2002).
- Data Source The Greater Yellowstone Ecosystem Interagency Whitebark Pine Monitoring Program monitors whitebark pine trees within the HPBH WSA. The protocol calls for all survey trees to be sampled once every four years to measure tree status (live or dead), presence of white pine blister rust, a general count of whitebark pine trees less than 1.4 meters tall, and evidence of MPB, fire, and other sources that may impact tree survival. In 2008, sampling of the panels was increased to every two years specifically to measure tree status and presence of MPB during the MPB epidemic observed across the Rocky Mountains. When the MPB epidemic ebbs, this schedule will revert to every four years (Rob Daley, personal communication).
- The number of living monitored trees during the period for which measure data was last compiled will be used to calculate the percentage of monitored whitebark pine that died and showed evidence of white pine blister rust. For example, at the end of surveys used to create the 2011 baseline for this measure there were 509 living whitebark pine trees across the 15 HPBH WSA monitoring sites; in 2016 this number will be used to calculate the percentage of trees that died and showed evidence of white pine blister rust.

Data Adequacy	The trees monitored for this measure may or may not represent whitebark pine conditions or trends within the HPBH WSA. Review of the data by a statistician is needed to establish the confidence with which these samples represent the larger WSA whitebark pine landscape. Data are not available for monitoring sites prior to 2004. The first sample cycle for this measure is represented by the data collected between 2004 and 2011.
Recent Trend(s)	<p>Results of past surveys of blister rust infection rates in the Greater Yellowstone Ecosystem (performed prior to the Greater Yellowstone Ecosystem Interagency Whitebark Pine Monitoring Program) showed average rates of <5% in Yellowstone NP and <15% in Grand Teton NP, with a highest single-site incidence of 40-44% in Grand Teton NP (Kendall and Keane 2001).</p> <p>Fourteen of 15 HPBH sites sampled between 2004 and 2011 contained evidence of blister rust in one or more living trees (Figure 5). When sampling was performed in 2004-2005, 44% of sampled trees showed evidence of blister rust. When the same trees were sampled in 2008-2011 along with 45 new trees that had established since 2005, 41% of sampled trees showed evidence of blister rust (Rob Daley, personal communication).</p>
2011 Baseline	Approximately 53% of trees surveyed between 2004 and 2011 showed evidence of blister rust infection (Figure 5; Rob Daley, personal communication). Less than 1% of the blister rust infected trees died during the survey period.
Relevance	<p>This measure monitors the extent of presence of an invasive pathogen, white pine blister rust. This introduced pathogen has been shown to increase mortality rates of an important native tree species, whitebark pine (Keane and Arno 1993).</p> <p>In 2011, the U.S. Fish & Wildlife Service granted whitebark pine warranted but precluded status as a threatened or endangered species. Whitebark pine is a keystone species within the Greater Yellowstone Ecosystem. Its seed is a critical food source for grizzly bears, red squirrels, and Clark's nutcracker. Whitebark pine mortality rates are increasing due to a number of factors; white pine blister rust infection is a significant contributor.</p>
Significant Change	TBD
Monitoring Frequency	This measure will be evaluated every four years in order to ensure a complete survey cycle of each of the 15 sites within the HPBH WSA, given possible fluctuations in funding availability and project prioritization.
References	<p>Keane, R.; Arno, S. 1993. Rapid decline of whitebark pine in western Montana: evidence from 20-year remeasurements. <i>Western Journal of Applied Forestry</i>. 8(2): 44-47.</p> <p>Kendall, K. C.; Keane, R. E. 2001. Whitebark pine decline: infection, mortality, and population trends. In: Tomback, D. F.; Arno, S. F.; Keane, R. E., eds. <i>Whitebark pine communities: ecology and restoration</i>. Island Press, Washington, D.C.: 221-242.</p> <p>Koteen, L. 2002. Climate change, whitebark pine, and grizzly bears in the Greater Yellowstone Ecosystem. In: Schneider, S.H.; Root, T.L., eds. <i>Wildlife Responses to Climate Change: North American Case Studies</i>. Island Press, Washington D.C.: 343-414.</p>

Greater Yellowstone Network Whitebark Pine Monitoring Working Group, 2011. Interagency Whitebark Pine Monitoring Protocol for the Greater Yellowstone Ecosystem, Version 1.1. Greater Yellowstone Coordinating Committee, Bozeman, MT.

Greater Yellowstone Network Whitebark Pine Monitoring Working Group. 2012. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2011 annual report. Natural Resource Data Series NPS/GRYN/NRDS—2012/278. National Park Service, Fort Collins, Colorado.
(<http://www.greateryellowstonescience.org/subproducts/14/7>)

Tomback, D. F.; Arno, S. F.; Keane, R. E. 2001. The compelling case for management intervention. In: Tomback, D.F.; Arno, S.F.; Keane, R.E., eds. Whitebark pine communities: ecology and restoration. Island Press, Washington D.C.: 3-25.

Figure 3. Mountain pine beetle evidence across whitebark pine monitoring sites, 2004-2011

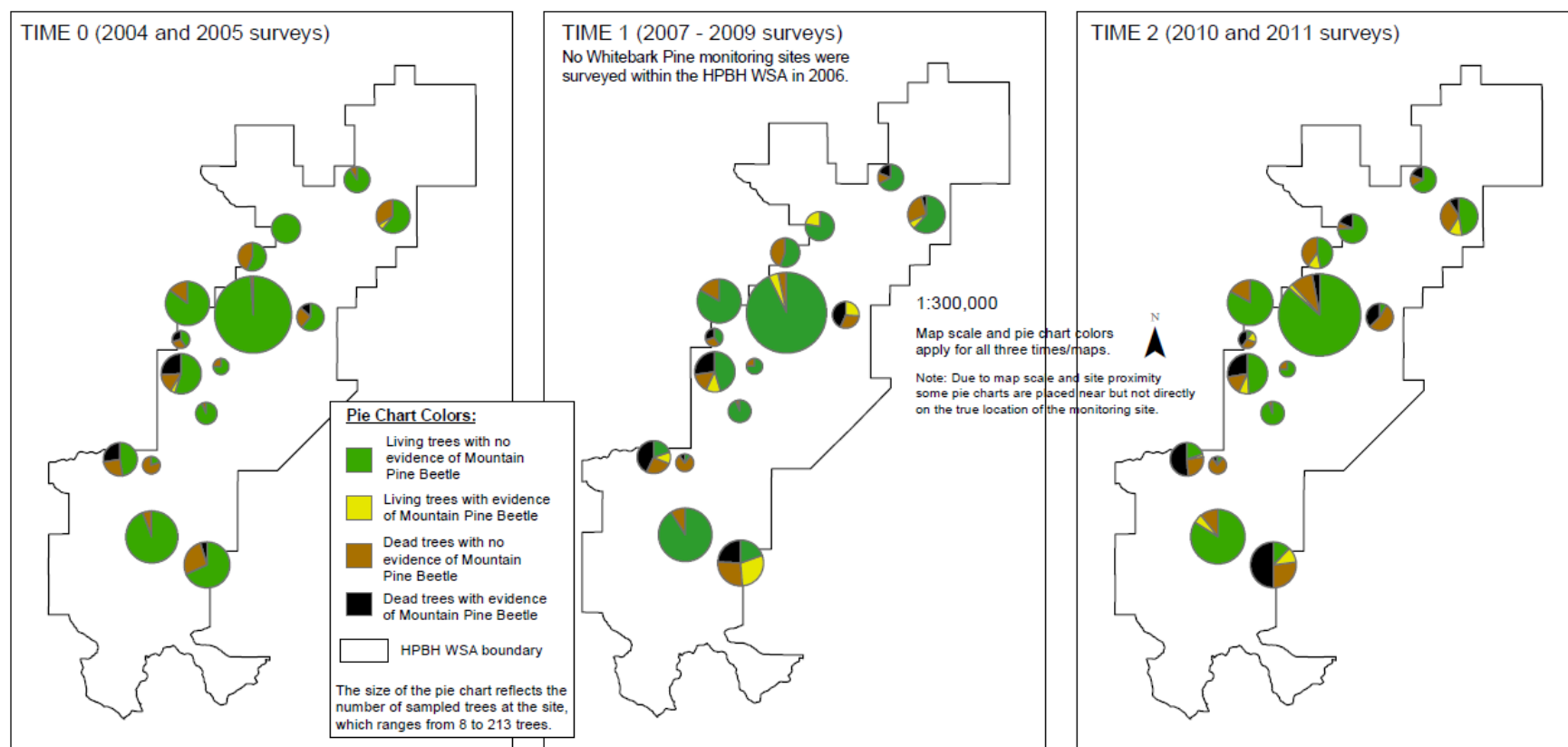
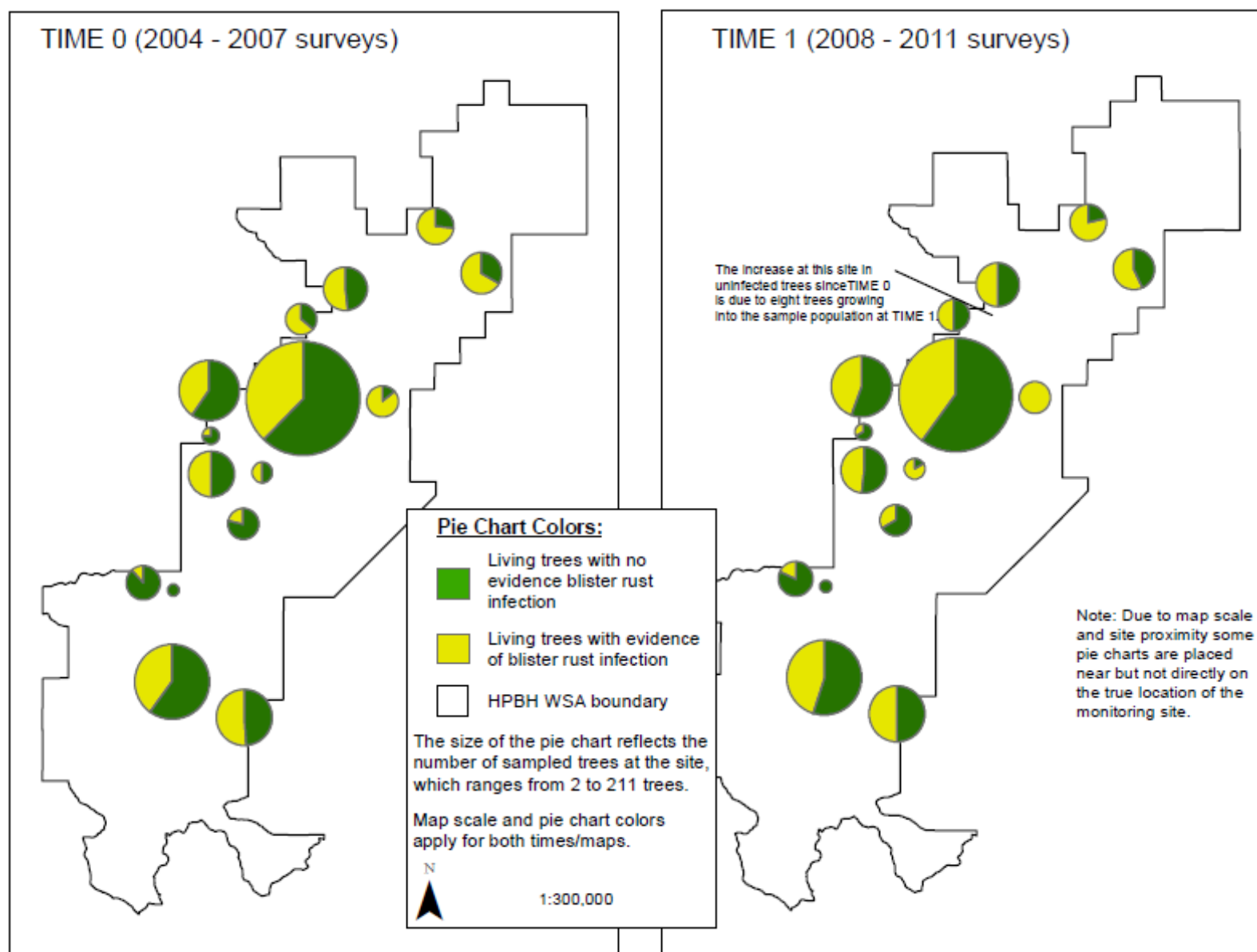


Figure 4. Blister rust evidence across whitebark pine monitoring sites, 2004-2011



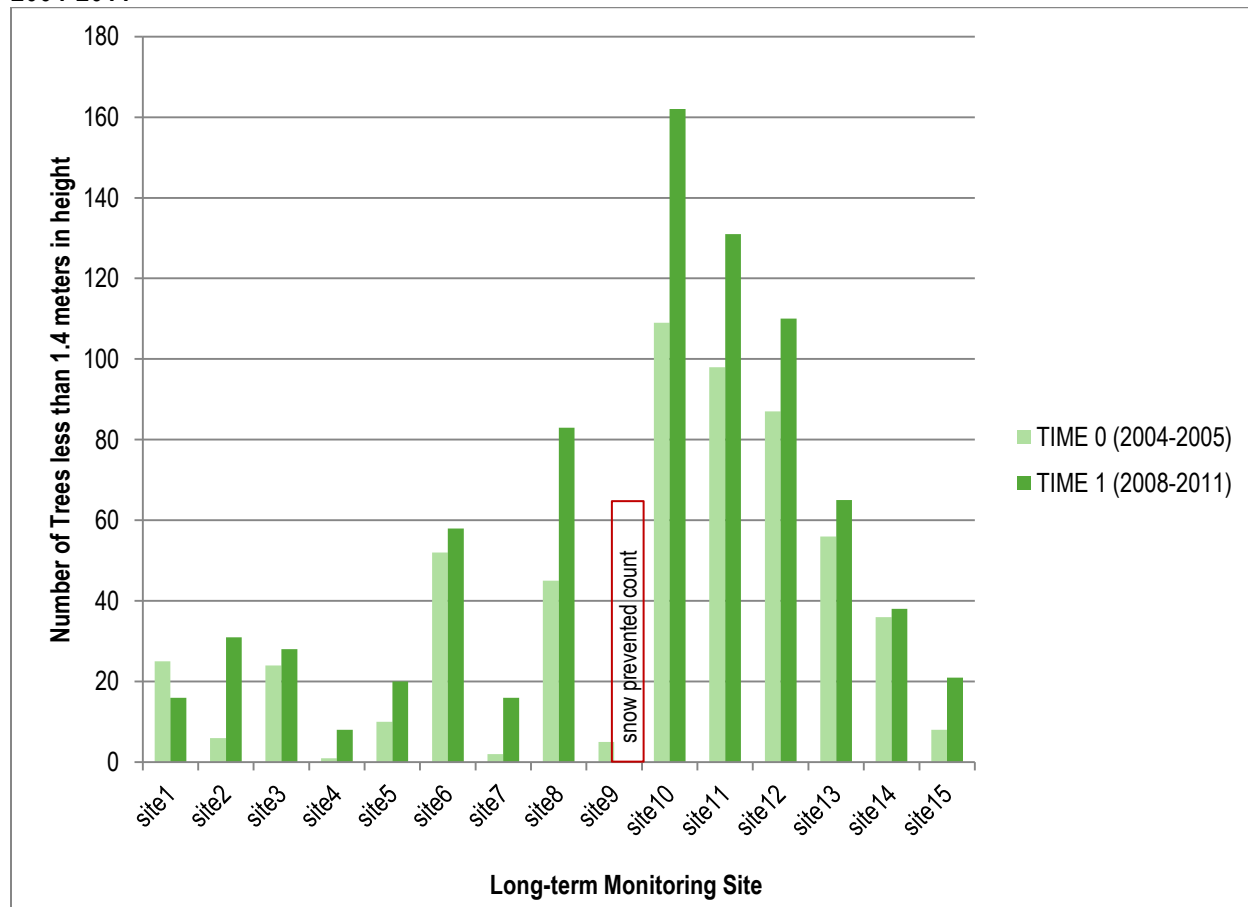
MEASURE 1-4 AVERAGE NUMBER OF WHITEBARK PINE SEEDLINGS PER MONITORED SITE

Definition	The average number of understory whitebark pine trees (<1.4 meters in height) per 500m ² monitored site.
Context	Studies have demonstrated increased mortality of mature whitebark pine in the U.S. intermountain west due to impacts of mountain pine beetle, blister rust, fire, and warming climate (Gibson et al. 2008). This increased mortality has resulted in the decline of many whitebark pine stands across the region. The presence of a new cohort of established whitebark pine seedlings in the understory of stands will increase the likelihood that mature whitebark pine are replaced by regenerating whitebark pine, instead of competing species.
Relevance	A decline in the average number of whitebark pine seedlings may indicate a decline in overall whitebark pine health and has implications for long-term presence of whitebark pine stands. A decline in the average number of whitebark pine seedlings is a possible indication of degradation of the natural quality of wilderness character.
Data Source	The Greater Yellowstone Ecosystem Interagency Whitebark Pine Monitoring Program monitors 587 whitebark pine trees taller than 1.4 meters at diameter-breast-height within the HPBH WSA. As a component of the monitoring program, trees less than 1.4 meters in height are also counted at each site. Each whitebark pine monitoring site is a 10m by 50m transect, which tracks the average number of seedlings within a 500m ² area.
Data Adequacy	During some visits early in the field season, understory trees are covered by snow. For surveys through 2009, the number of small trees recorded was zero for monitoring sites where snow cover prevented an actual count of understory trees. These zero values, when present, result in inaccurate averages that skew lower than the true number of seedlings.
Recent Trend(s)	<p>Data relevant to this measure has only been collected twice (in 2004-2005 and 2008-2011; Figure 3). For sites sampled in 2004 and 2005, there was 37.6 seedlings/500m². No sampled sites were under snow.</p> <p>2008-2011 data indicates an increase in seedlings, but more samples are necessary to establish a trend. See Figure 3 for data collected during the two sampling periods.</p>
2011 Baseline	For sites monitored between 2008 and 2011, there were an average of 52.5 seedlings/500m ² (Figure 3). One site was under snow during this sampling.
Significant Change	TBD
Monitoring Frequency	This measure will be evaluated every four years in order to ensure a complete survey cycle of each of the 15 sites within the HPBH WSA, given possible fluctuations in funding availability and project prioritization.
References	Gibson, K.; Skov, K.; Kegley, S.; Jorgensen, C.; Smith, S.; Witcosky, J. 2008. Mountain pine beetle impacts in high-elevation five-needle pines: current trends and challenges. USDA Forest Service, Forest Health Protection, R1-08-020. 32 p.

Greater Yellowstone Network Whitebark Pine Monitoring Working Group. 2011. Interagency Whitebark Pine Monitoring Protocol for the Greater Yellowstone Ecosystem, Version 1.1. Greater Yellowstone Coordinating Committee, Bozeman, MT.

Greater Yellowstone Network Whitebark Pine Monitoring Working Group. 2012. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2011 annual report. Natural Resource Data Series NPS/GRYN/NRDS—2012/278. National Park Service, Fort Collins, Colorado.
(<http://www.greateryellowstonescience.org/subproducts/14/7>)

Figure 5. Number of whitebark pine trees <1.4 meters in height across whitebark pine monitoring sites, 2004-2011



MEASURE 1-5 NUMBER OF NON-INDIGENOUS, NON-PLANT SPECIES

Definition	Number of non-indigenous, non-plant species likely present in the HPBH WSA.
Context	This measure monitors the total number of non-indigenous, non-plant species likely present within the WSA, regardless of whether the species is considered invasive or is actively being managed.
Relevance	Non-indigenous, non-plant species can compete with, infect, or kill indigenous, non-plant or plant species and alter the ecosystem's community and composition. As the number of non-indigenous, non-plant species increases the natural quality of the WSA is degraded.

- Data Source** Data came from the Montana Natural Heritage Program's Point Observation Database (POD), a resource developed to handle survey and observation data for mammals, amphibians, and reptiles in the state of Montana. A basic observation record in POD consists of species name, date, location, and location accuracy. The database is constructed from museum collection records, as well as observations from many biologists. The POD is accessed via the Natural Heritage TRACKER (<http://mtnhp.org/Tracker/NHTMap.aspx>).
- Data Adequacy** The Montana Natural Heritage Program data does not definitively indicate a species is present within the HPBH WSA, but does indicate that the species has been sighted within three miles of the WSA's boundary. The District Fisheries biologist, Bruce Roberts, reviewed the 2011 baseline list of species (below) and indicated that rainbow trout and Hungarian partridge should also be included, but currently these species are not included by the Montana Natural Heritage Program for the HPBH WSA.
- Recent Trend(s)** All non-indigenous, non-plant species likely present in the HPBH WSA were recorded in the region prior to 2000.
- 2011 Baseline** The Montana Natural Heritage Program has database records for 13 non-indigenous, non-plant species within three miles of the HPBH WSA boundary (Table 5).

Table 5. Non-indigenous, non-plant species present within 3 miles

Common Name	Scientific Name
American bullfrog	<i>Rana catesbeiana</i>
Brook trout	<i>Salvelinus fontinalis</i>
Brown trout	<i>Salmo trutta</i>
Dusky arion	<i>Arion subfuscus</i>
European skipper	<i>Thymelicus lineola</i>
European starling	<i>Sturnus vulgaris</i>
Rocky mountain goat	<i>Oreamnos americanus</i>
Ring-necked pheasant	<i>Phasianus colchicus</i>
Walleye	<i>Sander vitreus</i>
Whirling disease	<i>Myxobolus cerebralis</i>
White pine blister rust	<i>Cronartium ribicola</i>
Yellow perch	<i>Perca flavescens</i>

Significant Change TBD

Monitoring Frequency Every five years

References Montana Natural Heritage Program, <http://mtnhp.org/>

MEASURE 1-6 ABUNDANCE AND DISTRIBUTION OF INDIGENOUS AND NON-INDIGENOUS AQUATIC SPECIES

Definition The abundance and distribution (in stream miles whenever possible) of indigenous and non-indigenous aquatic species.

Context The Gallatin Crest is the boundary between the distribution of two native subspecies of cutthroat trout: Yellowstone cutthroat trout to the east (Yellowstone River drainage) and westslope cutthroat trout to the west (Gallatin River drainage). Three non-native trout have either been introduced

directly into HPBH streams or have migrated upstream from where they were originally introduced: rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*). (For more information about fish stocking in the HPBH WSA see Measure 3-5.) In addition, westslope cutthroat trout, Yellowstone cutthroat trout, and rainbow trout can all interbreed and produce two-way or three-way hybrids.

- Relevance** An increase in the abundance and/or distribution of non-indigenous aquatic species indicates a degradation of the natural quality of the WSA. Likewise, a decrease in the abundance and/or distribution of indigenous aquatic species is also an indicator of degrading natural quality (unless the decrease is attributable to a native, natural process).
- Data Source(s)** Bruce Roberts, Bozeman Ranger District fisheries biologist, provided a Specialist Report (2012). Montana Fish, Wildlife, and Parks Montana Fisheries Information System (MFISH) database. MFISH contains information of fish species distribution, supporting data for distribution, and information related to the management of aquatic resources in Montana. The database is managed and maintained by the Strategic Planning and Data Service Bureau (SPDS) or the Fish and Wildlife Division of Montana Fish, Wildlife, and Parks and is updated annually. The database can be accessed at <http://fwp.mt.gov/fishing/mFish/>
- Data Adequacy** Fish distribution data supplied by MFWP's MFISH are not always truncated where actual fish distribution ends along headwater streams. When possible, more accurate distribution data is provided on a stream-by-stream basis within the written narrative for this measure.
- Recent Trend(s)** See 2011 baseline.
- 2011 Baseline** Two indigenous cutthroat trout subspecies, Yellowstone (YCT) and westslope (WCT), currently inhabit HPBH WSA streams.

Gallatin River Drainage

Within the WSA, indigenous WCT occupy 12.3 Gallatin River drainage stream miles (Table 6). Non-indigenous trout within the Gallatin River drainage include Yellowstone cutthroat trout, rainbow trout (RBT), brown trout, and brook trout. Within the WSA, non-indigenous trout occupy 21.8 Gallatin River drainage stream miles (Table 7).

Yellowstone River Drainage

Within the WSA, indigenous Yellowstone cutthroat trout (either genetically pure or slightly hybridized) occupy 3.8 Yellowstone River drainage stream miles (Table 6). Yellowstone cutthroat trout of unknown genetic purity occupy another 1.8 miles. Non-indigenous stream-residing trout within the Yellowstone River drainage include brown trout, brook trout, and rainbow trout, and occupy 27.9 stream miles within the WSA.

Table 6. Indigenous trout distribution and genetic purity for HPBH WSA streams (Source: MFWP's MFISH)

Stream Name	Drainage	Species	Abundance	Genetic Purity	Occupied Miles	Last Update
Elkhorn Creek	Gallatin	WCT	Rare	100%	5.8	2009
Porcupine Creek	Gallatin	WCT	Unknown	Unknown	4.3	2009
North Fork Porcupine Creek	Gallatin	WCT	Rare	90.0%-99.9%	1.0	2011
Moose Creek	Gallatin	WCT	Common	90.0%-99.9%	1.2	2010
Tom Miner Creek	Yellowstone	YCT	Abundant	90.0%-99.9%	0.3	2011

Stream Name	Drainage	Species	Abundance	Genetic Purity	Occupied Miles	Last Update
Trail Creek	Yellowstone	YCT	Rare	100%	0.7	2011
Donahue Creek	Yellowstone	YCT	Common	100%	0.1	2005
Rock Creek	Yellowstone	YCT	Abundant	100%	1.4	2009
Cottonwood Creek	Yellowstone	To be sampled in 2012				
Bark Cabin Creek	Yellowstone	To be sampled in 2012				
Smokey Creek	Yellowstone	To be sampled in 2012				
Mist Creek	Yellowstone	To be sampled in 2012				
Bear Creek	Yellowstone	To be sampled in 2012				
Little Bear Creek	Yellowstone	To be sampled in 2012				
Cliff Creek	Yellowstone	YCT	Rare	Unknown	1.0	2011
Fridley Creek	Yellowstone	YCT	Unknown	100%	0.7	2009
Eightmile Creek	Yellowstone	YCT	Rare	Unknown	0.2	2009
Pine Creek	Yellowstone	YCT	Rare	Unknown	0.6	2005
Trail Creek	Yellowstone	YCT	Common	100%	0.6	2011

Table 7. Non-indigenous trout distribution and genetic purity for HPBH WSA streams (Source: MFWP's MFISH)

Stream Name	Drainage	Species	Abundance	Occupied Miles	Last Update
Porcupine Creek	Gallatin	RBT	Common	6.0	2005
		Brown Trout	Rare	6.0	2005
South Fork Swan Creek	Gallatin	Brook Trout	Rare	2.7	2009
Swan Creek	Gallatin	Brook Trout	Rare	4.4	2009
Storm Castle Creek	Gallatin	RBT	Common	1.0	2005
		Brown Trout	Rare	1.0	2005
		Brook Trout	Rare	1.0	2009
South Cottonwood Creek	Gallatin	RBT	Abundant	2.8	2009
		Brown Trout	Rare	2.8	2005
		Brook Trout	Common	2.8	2005
Hyalite Creek	Gallatin	YCT	Common	3.5	2005
		Brook Trout	Common	3.5	2009
South Fork Bozeman Creek	Gallatin	RBT	Common	1.4	2005
		Brook Trout	Common	1.4	2005
Rock Creek	Yellowstone	Brown Trout	Unknown	5.0	2005
Big Creek	Yellowstone	YCT x RBT	Rare	2.3	2009
		RBT	Common	2.3	2005
		Brown Trout	Rare	2.3	2008
Cottonwood Creek	Yellowstone	To be sampled in 2012			
Bark Cabin Creek	Yellowstone	To be sampled in 2012			

Table 7 continued on following page

Table 7. (continued from previous page)

Stream Name	Drainage	Species	Abundance	Occupied Miles	Last Update
Smokey Creek	Yellowstone	To be sampled in 2012			
Mist Creek	Yellowstone	To be sampled in 2012			
Bear Creek	Yellowstone	To be sampled in 2012			
Little Bear Creek	Yellowstone	To be sampled in 2012			
Cliff Creek	Yellowstone	Rainbow Trout	Rare	2.5	2011
Lewis Creek	Yellowstone	Rainbow Trout	Rare	2.7	2011
Fridley Creek	Yellowstone	Rainbow Trout	Rare	1.8	2005
		Brook Trout	Common	1.8	2005
Eightmile Creek	Yellowstone	Rainbow Trout	Rare	2.8	2005
		Brook Trout	Rare	2.8	2005
South Fork Eightmile Creek	Yellowstone	Rainbow Trout	Rare	3.9	2005
		Brook Trout	Rare	3.9	2005
North Fork Eightmile Creek	Yellowstone	Rainbow Trout	Rare	3.4	2005
		Brook Trout	Rare	3.4	2005
Pine Creek	Yellowstone	Rainbow Trout	Rare	1.9	2005
Trail Creek	Yellowstone	Brown Trout	Rare	1.6	2005

Future Monitoring Western pearshell mussel (*Margaritifera falcate*) was recently placed on the Region 1 Sensitive Species List for the Gallatin National Forest. This species typically occupies fish-bearing lower gradient mid- to large-size streams and rivers. Historically, westslope cutthroat trout was an intermediate host for this mussel species. The western pearshell mussel's native range extends north to south from Alaska to California, but it was not historically found east of the Gallatin River drainage in the HPBH WSA. Lower Porcupine Creek is the only stream that could possibly meet this species' life history requirements.

There are five native, non-game Catostomidae and Cottidae fish species that possibly occupy lower elevation HPBH streams: mountain whitefish (*Prosopium williamsoni*), mountain sucker (*Catostomus platyrhynchus*), longnose sucker (*C. catostomus*), white sucker (*C. commersoni*), and mottled sculpin (*Cottus bairdii*). These species may also occupy larger tributaries such as Porcupine Creek and Big Creek, but these tributaries have not been surveyed.

Myxobolus cerebralis is considered an Aquatic Invasive Species (AIS) in Montana and it causes whirling disease in various Salmonidae family species. It is not known whether *Myxobolus cerebralis* is currently present within the HPBH WSA, although it is present in the Gallatin and Yellowstone Rivers.

Significant Change TBD

Monitoring Frequency Every five years

References Roberts, Bruce. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library).

MEASURE 1-7 PERCENT OF AREA OCCUPIED BY NON-INDIGENOUS, INVASIVE PLANT SPECIES

Definition	Percent of total HPBH WSA area known to contain non-indigenous, invasive plant species.
Context	<p>Invasive plant species have become an increasing concern across wilderness and non-wilderness areas throughout the western United States. Invasive plant species can be transported into the HPBH WSA via recreational users, vehicles, wildlife, livestock, pack stock, fire suppression crews and equipment, or other vectors. Concerted efforts to map and monitor invasive plant species within the HPBH WSA have focused on trail corridors and popular recreational areas.</p> <p>In order to reduce the introduction of invasive plant species, the Gallatin National Forest implemented a special order requiring weed-free feed in 1993. It was subsequently updated by an expanded order for the Greater Yellowstone Area, and then lastly by a Northern Region Special Order in 1997. All feed, hay, or forage transported onto the Gallatin National Forest is required to be weed seed-free.</p> <p>Invasive species management efforts are most effective when focused on reducing or extirpating invasive species with a total area of less than one acre. With increased presence (both number of stems and total area) efforts to reduce or extirpate the species become less effective, more costly, and more impactful to wilderness character. This measure assesses total acreage of the HPBH occupied by invasive plant species.</p>
Relevance	Invasive plant species degrade the natural quality of wilderness by altering the plant and animal community through outcompeting native plant species, altering soil chemistry, displacing native food sources for wildlife, and other impacts. As acres of invasive plant species increases the natural quality of wilderness character is degraded.
Data Source	<p>Backcountry rangers began to compile weed inventories within the HPBH WSA in 2001. In 2011, backcountry ranger efforts were supplemented by University of Montana Wilderness Institute citizen science crews.</p> <p>2011 data was collected by University of Montana Wilderness Institute crews who hiked every trail in the HPBH WSA between June and September 2011. Wilderness Institute crews spent 66 field days in the HPBH WSA and covered over 250 miles of system and non-system trails. Crews were trained to identify and characterize weed infestations. At weed sites, crews took GPS locations and size estimates for all patches of invasive species. The spatial extent of weed patches was measured in the field by walking the patch perimeter with a GPS or by visual estimation.</p>
Data Adequacy	<p>The mapping of invasive species has largely relied on backcountry ranger and Wilderness Institute efforts. In both cases, trail corridors were traveled and examined for presence of invasive species. When Wilderness Institute crews located large weed patches, the entire extent of the infestation was not always mapped, particularly when the terrain or distance from the trail made walking the entire perimeter unfeasible. Furthermore, concerted efforts have not been made to detect and map invasive plant populations outside immediate trail corridors and popular recreation sites. Consequently, the data included in this measure should be considered a minimum value. Data collected in 2011 indicates that the acres occupied by these species has increased since 2003. It is important to note that increased acreage values may indicate spread, but also may be a result of increased survey efforts to map and detect invasive plant presence.</p>
Recent trend(s)	In 2003, 53.1 acres (<0.1%) of the HPBH WSA was known to contain non-indigenous, invasive plant species. At that time, Canada thistle (<i>Cirsium arvense</i>) was the most prominent invasive

(33.4 acres), followed by houndstongue (*Cynoglossum officinale*, 13.8 acres), and the HPBH was considered only lightly infected with noxious weeds as compared to other areas of the Gallatin National Forest (Schlenker 2003).

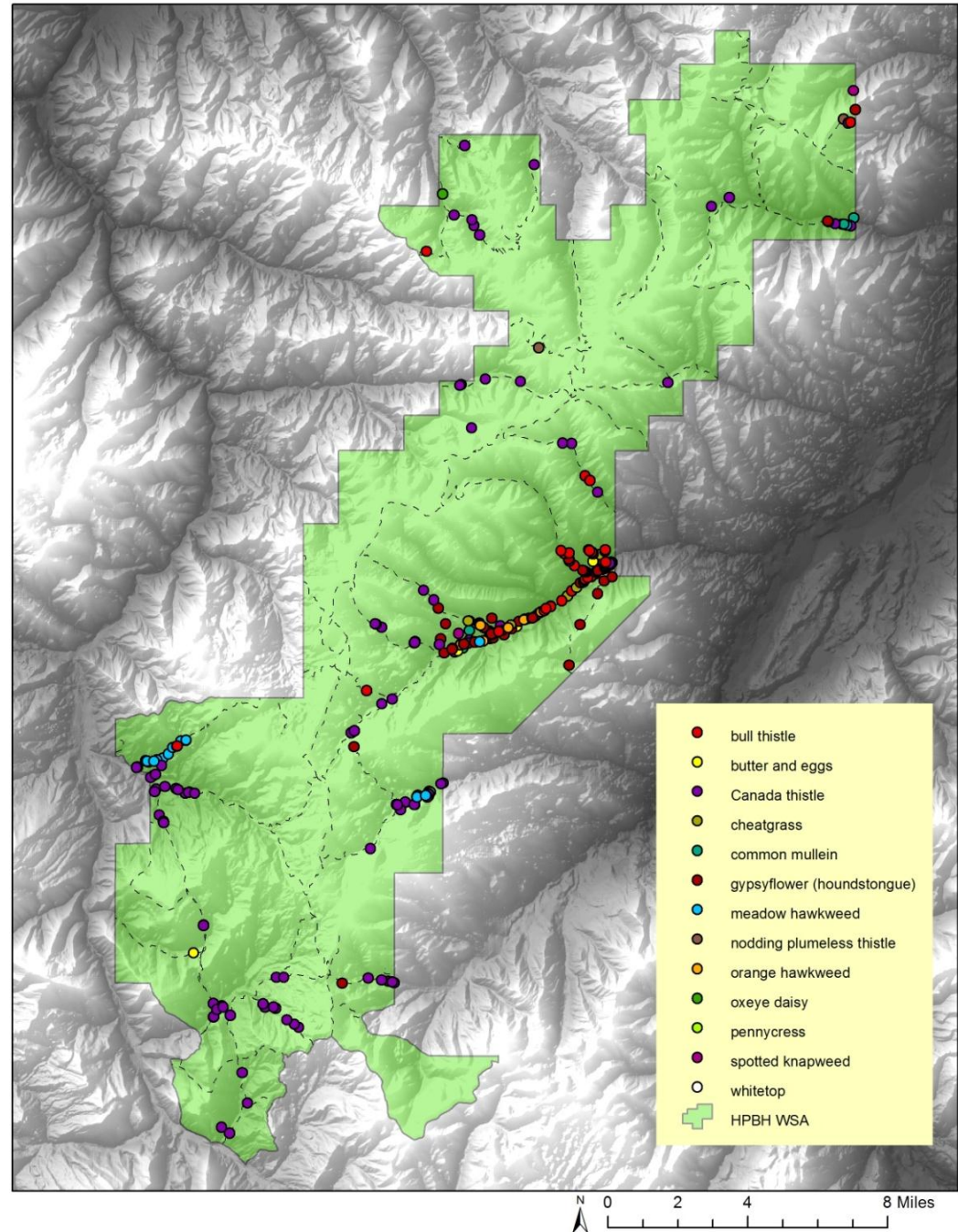
Data collected in 2011 documented an increase in acres occupied by all species present in 2003, with the exception of Dalmatian toadflax (*Linaria dalmatica*), which was not documented in the most recent survey. In addition, crews documented the presence of nine new species. Documented infestations were concentrated at lower elevations within a few miles of several high-use trailheads, particularly Big Creek, Porcupine Creek, and Eightmile Creek. The central, higher elevation “spine” of the WSA was largely weed-free.

2011 Baseline 2011 sampling indicated that 334.6 acres (0.2%) of the HPBH WSA was occupied by non-indigenous invasive plant species (Table 8).

Table 8. Acres within the HPBH WSA occupied by invasive plant species

Common Name	Scientific Name	Acres occupied
Houndstongue (Gypsyflower)	<i>Cynoglossum officinale</i>	129.2
Canada thistle	<i>Cirsium arvense</i>	96.21
Nodding plumeless thistle (Musk thistle)	<i>Carduus nutans</i>	31.54
Spotted knapweed	<i>Centaurea maculosa</i>	28.99
Common mullein	<i>Verbascum thapsus</i>	23.1
Yellow toadflax (Butter and eggs)	<i>Linaria vulgaris</i>	9.04
Oxeye daisy	<i>Leucanthemum vulgare</i>	8.05
Bull thistle	<i>Cirsium vulgare</i>	3.73
Orange hawkweed	<i>Hieracium aurantiacum</i>	2.62
Meadow hawkweed	<i>Hieracium caespitosum</i>	1.74
Cheatgrass	<i>Bromus tectorum</i>	0.16
Pennycress	<i>Thlaspi arvense</i>	0.125
Whitetop	<i>Lepidium draba</i>	0.1
Common tansy	<i>Tanacetum vulgare</i>	0.0001
Diffuse knapweed	<i>Centaurea diffusa</i>	0.0001
Hoary alyssum	<i>Berteroa incana</i>	0.0001
Sulfur cinquefoil	<i>Potentilla recta</i>	0.0001

Figure 6. Distribution of invasive plants by species, 2011



Significant Change TBD

Monitoring Frequency Every five years

References Gallatin National Forest Weed Database (FACTS)

Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

MEASURE 1-8 NUMBER OF INVASIVE PLANT SPECIES

Definition	Number of invasive plant species known to be present in the HPBH WSA.
Context	<p>Invasive plant species are an increasing concern across wilderness and non-wilderness areas throughout the United States. Invasive plant species can be transported into the HPBH WSA via recreational users, vehicles, wildlife, livestock, pack stock, or fire suppression crews and equipment. Concerted efforts to map and monitor invasive plant species within the HPBH WSA have focused on trail corridors and popular recreational areas.</p> <p>To reduce the introduction of invasive plant species, the Gallatin National Forest implemented a special order requiring weed-free feed in 1993. It was subsequently updated by an expanded order for the Greater Yellowstone Area, and then lastly by a Northern Region Special Order in 1997. All feed, hay, or forage transported onto the Gallatin National Forest is required to be weed seed-free.</p>
Relevance	Invasive species degrade the natural quality of wilderness character by altering the plant and animal community through outcompeting native plant species, altering soil chemistry, displacing native food sources for wildlife, and other impacts. As the number of invasive plant species increases the natural quality of wilderness character is degraded.
Data Source	<p>Backcountry rangers began to compile weed inventories within the HPBH WSA in 2001. In 2011, backcountry ranger efforts were supplemented by University of Montana Wilderness Institute citizen science crews.</p> <p>2011 data was collected by University of Montana Wilderness Institute crews who hiked every trail in the HPBH WSA between June and September 2011. Wilderness Institute crews spent 66 field days in the HPBH WSA and covered over 250 miles of system and non-system trails. Crews were trained to identify and characterize weed infestations. At all weed sites, crews took GPS locations and size estimates.</p>
Data Adequacy	The inventory of invasive plant species has largely relied on the efforts of backcountry rangers and crews directed by the University of Montana's Wilderness Institute. In both cases, trail corridors were traveled and invasive plant species were identified and inventoried. No concerted efforts to detect invasive plant species outside immediate trail corridors and popular recreation sites have been made. 2011 data shows an increased number of invasive plant species compared to 2003. This increase, however, could, at least in part, reflect increased survey efforts in 2011 (e.g. species undocumented in 2003 may have been present but gone undetected).
Recent trend(s)	In 2003, there were seven known invasive plant species present in the HPBH WSA (Table 9). Since then the number of known, present invasive species has more than doubled.
2011 Baseline	In 2011, there were 17 known invasive plant species present in the HPBH WSA (Table 9).

Table 9. Invasive plant species present, 2003 & 2011

Common Name	Scientific Name	Present	
		2003	2011
Bull thistle	<i>Cirsium vulgare</i>		X
Canada thistle	<i>Cirsium arvense</i>	X	X
Cheatgrass	<i>Bromus tectorum</i>		X
Common mullein	<i>Verbascum thapsus</i>	X	X
Common tansy	<i>Tanacetum vulgare</i>		X
Dalmatian toadflax	<i>Linaria dalmatica</i>	X	
Diffuse knapweed	<i>Centaurea diffusa</i>		X
Hoary alyssum	<i>Berteroa incana</i>		X
Houndstongue (Gypsyflower)	<i>Cynoglossum officinale</i>	X	X
Meadow hawkweed	<i>Hieracium caespitosum</i>		X
Nodding plumeless thistle (Musk thistle)	<i>Carduus nutans</i>	X	X
Orange hawkweed	<i>Hieracium aurantiacum</i>		X
Oxeye daisy	<i>Leucanthemum vulgare</i>	X	X
Pennycress	<i>Thlaspi arvense</i>		X
Spotted knapweed	<i>Centaurea maculosa</i>		X
Sulfur cinquefoil	<i>Potentilla recta</i>		X
Whitetop	<i>Lepidium draba</i>	X	X
Yellow toadflax (Butter and eggs)	<i>Linaria vulgaris</i>		X

Significant Change TBD

Monitoring Frequency Every five years

References Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

MEASURE 1-9 ACRES OF GRAZING ALLOTMENTS WITH AUTHORIZED USE

Definition Acres within the HPBH WSA for which grazing permittees have been authorized to graze livestock.

Context Grazing has occurred in the HPBH WSA since approximately 1901.

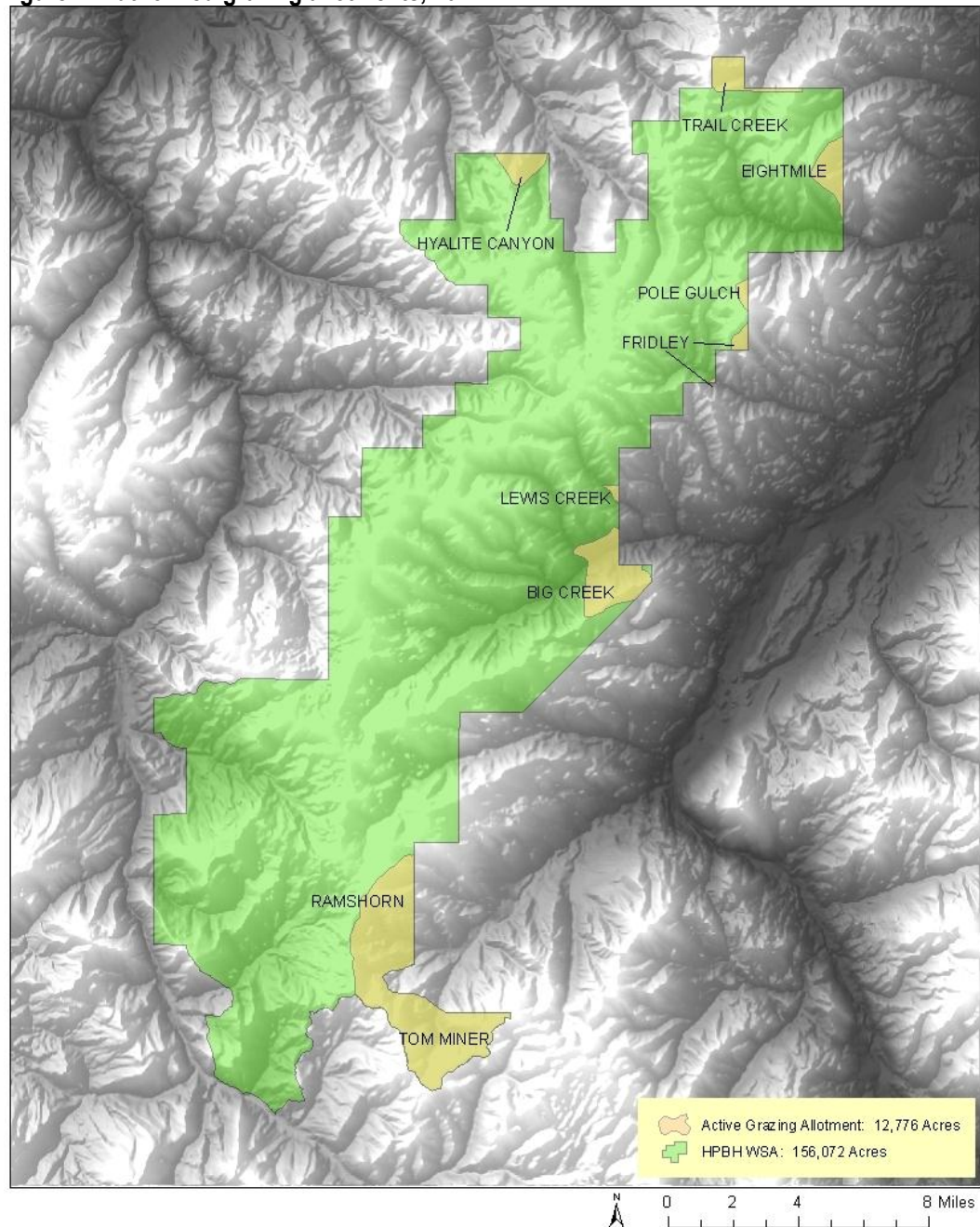
Grazing acreage has changed in the HPBH over the last century due to 1) the introduction of the National Environment Policy Act (NEPA) process in 1969, which resulted in modified allotment boundaries that more accurately represent livestock grazing habits (e.g. movement of boundaries from ridgelines to the base of steep, ungrazable slopes); 2) the use of more accurate computer-generated maps; 3) changes in landownership; and 4) changes in the landscape (e.g. fire suppression resulting in meadow reduction through conifer encroachment).

Furthermore, allotments are occasionally closed by the Forest Service for reasons including inability to support minimum head/month, death of a permittee without transfer of the permit,

changes in landownership, changes in the landscape, or USFS revocation of a permit in order to meet habitat or wildlife management goals.

Relevance	The foraging habitats of domesticated livestock have been shown to be different than those of indigenous grazers, impacting vegetative communities and nutrient cycles. The presence of domesticated livestock degrades the natural quality of wilderness character.
Data Source	Data was obtained from the Gallatin National Forest GIS library. The Gallatin National Forest West & East Zone Range Specialists provided historical and contextual information.
Data Adequacy	This measure reflects the total acres where authorized grazing may have occurred in a given year. It does not guarantee that grazing occurred on all authorized acres.
Recent trend(s)	In 2003, ten allotments (eight active) were identified within the study area, although only portions of each were actually located within the WSA boundary. The 2003 active allotments totaled approximately 17,100 acres and the estimated grazing capacity of the allotments was 5,290 animal unit months (AUMs), with 294 AUMs permitted. In the ten years prior to 2003, the number of AUMs permitted was reduced.
2011 Baseline	In 2011, 12,776 acres within the HPBH WSA were authorized for use by grazing permittees. These acres constitute nine separate allotments authorized for use by eight permittees. The allotments are Lewis Creek, Big Creek, Eightmile, Pole Gulch, Fridley, Trail Creek, Hyalite, Ramshorn, and Tom Miner. Ramshorn and Tom Miner are grazed by the same permittee.

Figure 7. Authorized grazing allotments, 2011



Significant Change TBD

Monitoring Frequency Every five years. This frequency is attainable due to the Gallatin National Forest Range Specialists' goal to inspect each grazing allotment every three years.

References Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

Indicator Physical resources

Air quality measures

Background

Four measures have been defined to track trends in HPBH air quality conditions, including visibility, particulate matter, deposition, and biological indicators. Data for these measures have been extrapolated from local and regional monitoring sources. In 2008, a Wilderness Air Quality Value (WAQV) Class 2 Monitoring Plan was prepared for the Absaroka Beartooth and Lee Metcalf Wilderness areas. In addition, in 2009, a General Technical Review (GRT) on air quality for USFS R1 was published. The National Atmospheric Deposition Program (NADP) and Interagency Monitoring of Protected Visual Environments (IMPROVE) continue to collect air quality data. For the four air quality measures, Mark Story, Gallatin National Forest hydrologist, compiled detailed, relevant data into a specialist report and Jill (Grenon) McMurry provided updates to that report in June 2012.

MEASURE 1-10 AVERAGE DECIVIEW

Definition	Visibility based on average deciview.
Context	Deciview is a cumulative haziness index used to express light extinction. Light extinction is measured in units of inverse megameters (Mm^{-1}) and is a measure of the amount of image-forming information lost in a sight path due to aerosols in the atmosphere. The deciview unit, a haze index, measures visibility derived from calculated light extinction measurements. Uniform changes in the haze index correspond to uniform incremental changes in visual perception across the entire range of conditions, from pristine to highly impaired.
Relevance	The natural quality of wilderness is degraded if visibility declines.
Data Source	<p>No visibility monitoring stations are located in or immediately adjacent to the HPBH. Two IMPROVE sites are, however, in the vicinity. The Lake Ranger Station site (YELL2) is 53 miles away in Yellowstone National Park and the Dead Indian Pass site (NOAB2) is 79 miles away in the North Absaroka Wilderness. These sites have been operated since 1997 and 2000 (respectively).</p> <p>Deciview measurements are taken daily at IMPROVE stations. All deciview trend data is publicly available at the IMPROVE website: http://vista.circa.colostate.edu/improve.</p>
Data Adequacy	Data collected by the IMPROVE stations are highly reliable.
Recent trend(s)	Trends for the Lake Ranger Station site show a slight, but statistically significant, improvement in visibility between 1997 and 2010, with the lowest recent visibility in 2000 and 2001 during robust wildfire seasons in the northern Greater Yellowstone area (Grenon and Story 2009).
2011 Baseline	<p>IMPROVE has not yet made 2011 data available. The 2010 average deciview across the two IMPROVE stations was approximately 7.0 Mm^{-1}.</p> <p>The professional opinion of Gallatin National Forest hydrologist, Mark Story, is that visibility in the HPBH is excellent due to the absence of large stationary sources of particulate pollution, generally dry air, and robust wind dispersion.</p>
Significant Change	TBD

Monitoring Frequency Every five years

References Grenon, J.; Story, M. 2009. U.S. Forest Service Region 1 Lake Chemistry, NADP, and IMPROVE air quality data analysis. Gen. Tech. Rep. RMRS-GTR-230WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42 p.

Story, Mark. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library). Updated by Jill (Grenon) McMurry, 6/2012.

MEASURE 1-11 AVERAGE SUM OF ANTHROPOGENIC FINE NITRATE AND SULFATE

Definition The average sum of measured anthropogenic fine nitrate and sulfate.

Context Fine particulate matter, including nitrogen and sulfate, contribute substantially to reduced visibility (haze). Anthropogenic sources of fine nitrate and sulfate include industrial sites, agricultural sites, vehicles, municipalities, prescribed fire, and agricultural burning. Fine particles both absorb and reflect light. The type of particulate matter (sulfates, nitrates, etc.) and the condition (humid, dry, etc.) of the pollution particle affect how much light is scattered.

Relevance Fine nitrate and sulfate directly indicate degradation of visibility conditions. The natural quality of wilderness is degraded if visibility declines.

Data Source No fine nitrate and sulfate monitoring stations are located in or immediately adjacent to the HPBH. Two IMPROVE sites are, however, in the vicinity. The Lake Ranger Station site (YELL2) is 53 miles away in Yellowstone National Park and the Dead Indian Pass site (NOAB2) is 79 miles away in the North Absaroka Wilderness. These sites have been operated since 1997 and 2000 (respectively). The Lake Ranger Station site was used as the HPBH index for this measure.

Fine nitrate and sulfate measurements are taken weekly at IMPROVE sites. All deciduous trend data is publicly available at the IMPROVE website: <http://vista.circa.colostate.edu/improve>.

Data Adequacy Data collected by the IMPROVE sites are highly reliable.

Recent trend(s) Grenon and Story (2009) found no statistically significant trends at the Lake Ranger Station IMPROVE site for either sulfate or nitrate between 2000 and 2008. This is consistent with most IMPROVE sites in the Northern Rockies. Between 1997 and 2010 fine nitrate at the Lake Ranger Station site averaged approximately 0.3 Mm^{-1} and fine sulfate averaged approximately 0.4 Mm^{-1} .

2011 Baseline IMPROVE has not yet made 2011 data available. The 2010 average sum of anthropogenic fine nitrate and sulfate from the Lake Ranger Station IMPROVE site was 0.061 Mm^{-1} for nitrate and 0.417 Mm^{-1} for sulfate for a total of 0.478 Mm^{-1} .

Significant Change TBD

Monitoring Frequency Every five years

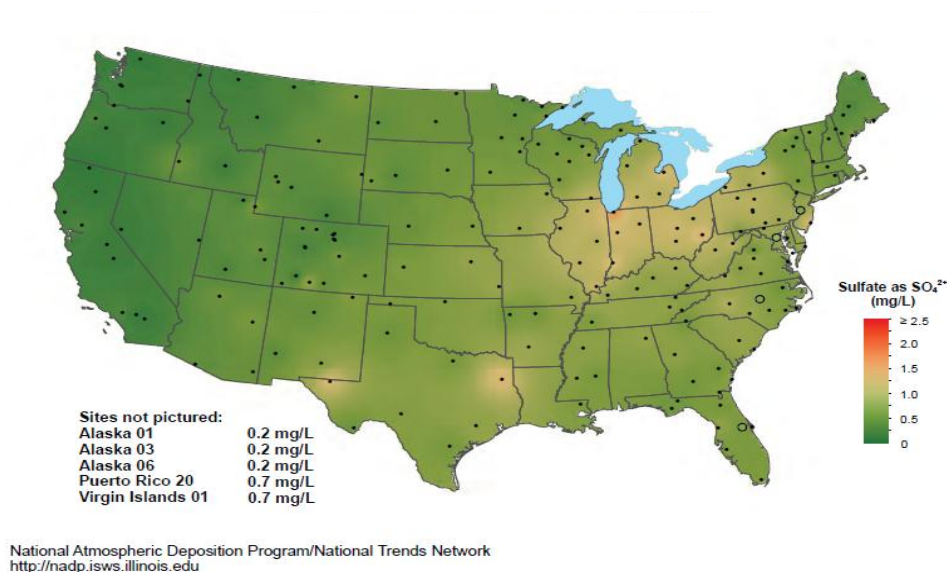
References Grenon, J.; Story, M. 2009. U.S. Forest Service Region 1 Lake Chemistry, NADP, and IMPROVE air quality data analysis. Gen. Tech. Rep. RMRS-GTR-230WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42 p.

MEASURE 1-12 CONCENTRATION OF SULFUR IN PRECIPITATION

Definition The concentration, in mg/L, of sulfur (SO_4) in rain and snow.

Context Sulfate pollution is typically associated with industrial practices. For example, industrial centers of the United States, such as the Midwest, show very high sulfate concentration rates. The HPBH lies within one of the areas of the country with the lowest sulfate ion concentrations. Overall U.S. sulfate ion concentrations have gradually declined over the last several decades as large industrial sites have shut down, technology to improve air sulfate emissions has been installed at existing and new industrial sites, and the sulfur has been reduced in diesel fuel for mobile sources. Figure 8 (below) depicts average sulfate ion concentrations across all monitored NADP sites for 2010.

Figure 8. United States sulfate ion concentration, 2010



Relevance The concentration of sulfur in rain and snow is a major contributor to acid deposition, which adversely affects algae, aquatic invertebrates, amphibians, fish, soil microorganisms, plants, and trees. The natural quality of wilderness is degraded if sulfur concentrations increase.

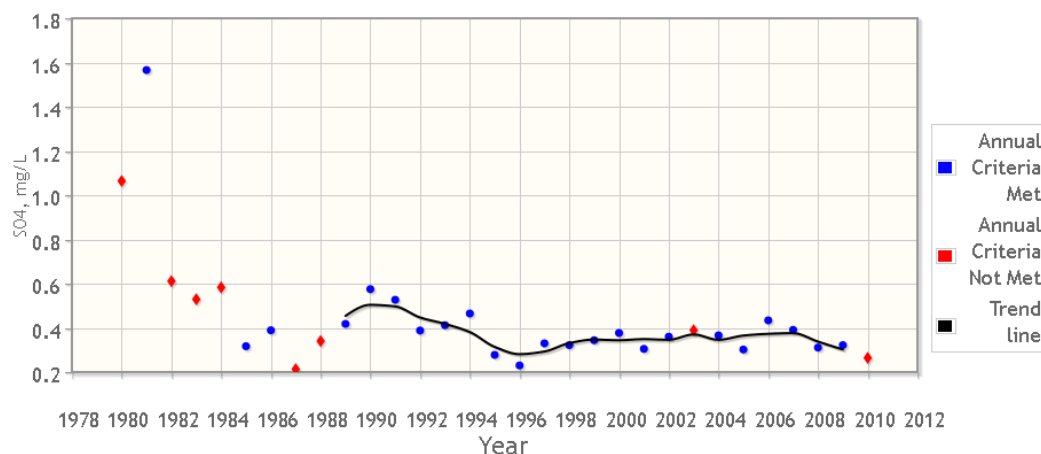
Data Source The closest sulfur monitoring NADP site in the HPBH region is located at Tower Junction in Yellowstone National Park (WY08 site). This site was established in 1980. Data from this site is used to represent conditions surrounding the HPBH WSA.

Data is collected at the Tower Junction NADP site weekly. Data reflected in this measure is an annual average of all samples. All data is publicly available at the NADP website:
<http://nadp.sws.uiuc.edu/maps/Default.aspx>

Data Adequacy Data collected by the Tower Junction NADP site is highly reliable.

Recent Trend(s) Sulfate levels decreased in a statistically significant trend annually and for all four seasons in the period between 1980 and 2006 (Grenon and Story 2009; Figure 9). The Tower Junction NADP site averaged approximately 0.3 mg/L SO₄ concentration in 2008 and 2009. Data for 2010 did not meet the NADP QA/QC criteria.

Figure 9. NADP/NTN site WY08 annual SO₄ concentrations, 1980-2010



2011 Baseline NADP has not yet made 2011 data available.

Significant Change TBD

Monitoring Frequency Every five years

References Grenon, J.; Story, M. 2009. U.S. Forest Service Region 1 Lake Chemistry, NADP, and IMPROVE air quality data analysis. Gen. Tech. Rep. RMRS-GTR-230WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42 p.

Story, Mark. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library). Updated by Jill (Grenon) McMurry, 6/2012.

MEASURE 1-13 CONCENTRATION OF NITRATE IN PRECIPITATION

Definition The concentration, in mg/L, of nitrogen (NO₃) in rain and snow.

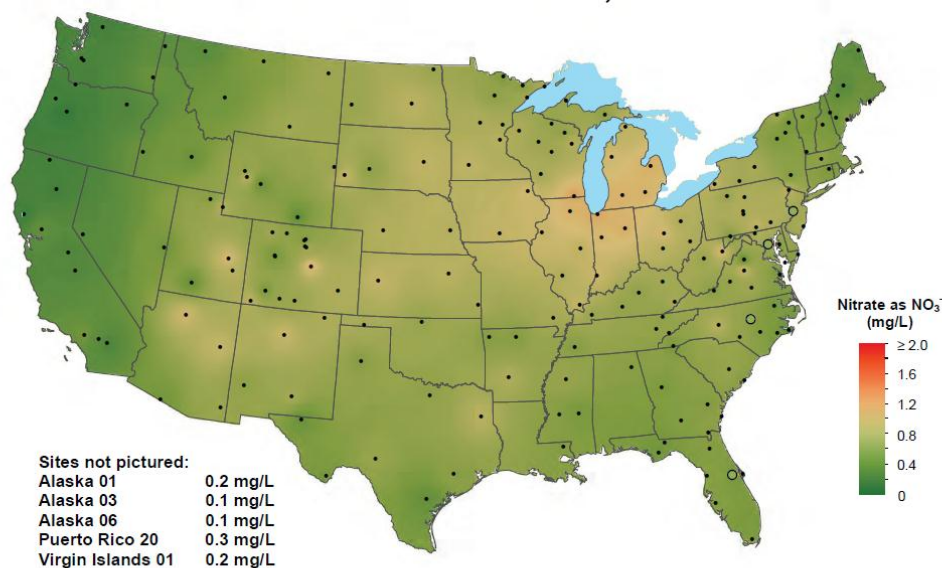
Context Nitrate concentrations are sensitive to local vehicle emissions. In the Northern Rocky Mountains, nitrate levels over the last several decades have slowly increased, particularly around urban areas. Figure 7 (below) depicts average nitrate concentrations across all monitored NADP sites for 2009.

Relevance Nitrate pollution contributes to the acidification of rain and snow chemistry, which adversely affects algae, aquatic invertebrates, amphibians, fish, soil microorganisms, plants, and trees. The natural quality of wilderness is degraded if nitrogen concentrations increase.

Data Source The closest and most diagnostic nitrogen monitoring NADP site in the region surrounding HPBH is located at Tower Junction in Yellowstone National Park (WY08 site). This site was established in 1980. Data from this site is used to represent conditions surrounding the HPBH WSA.

Data is collected at the Tower Junction NADP site 35-50 times per year. Data reported in this measure includes an annual average (average of all samples collected per year). All data is publicly available at the NADP website: <http://nadp.sws.uiuc.edu/maps/Default.aspx>.

Figure 10. United States nitrate ion concentration, 2010

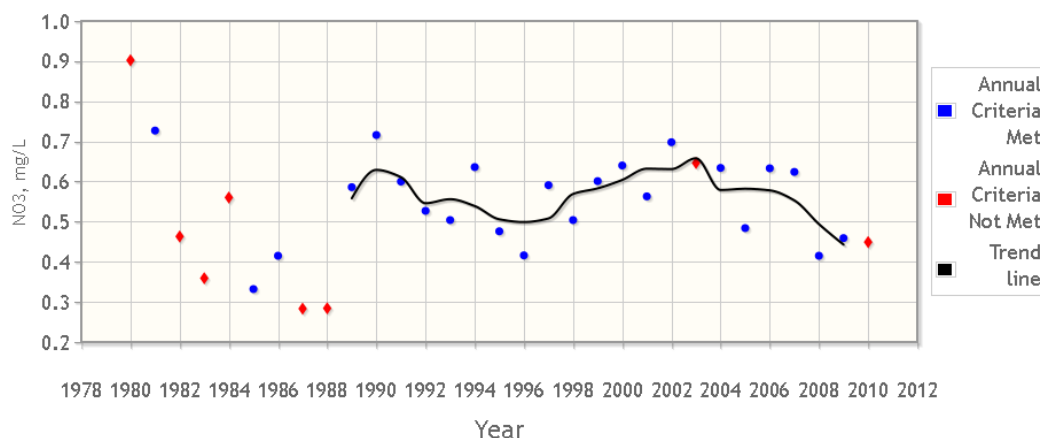


National Atmospheric Deposition Program/National Trends Network
<http://nadp.sws.uiuc.edu>

Data Adequacy Data collected by the Tower Junction NADP site is highly reliable. Only wet measurements, however, are considered in the NADP program. In the northern Rocky Mountains, dry deposition of nitrogen can account for 15-30% of total annual deposition.

Recent trend(s) Nitrate levels showed no statistically significant annual trend between 1980 and 2006 (Grenon and Story 2009; Figure 11), but increased slightly in the spring quarter each year. Since 2004, the Tower Junction NADP site averaged approximately 0.5 mg/L NO_3 concentration (Figure 11).

Figure 11. NADP/NTN site WY08 annual NO₃ concentrations, 1980-2010



2011 Baseline NADP has not yet made 2011 data available.

Significant Change TBD

Monitoring Frequency Every five years

References Grenon, J.; Story, M. 2009. U.S. Forest Service Region 1 Lake Chemistry, NADP, and IMPROVE air quality data analysis. Gen. Tech. Rep. RMRS-GTR-230WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42 p.

Story, Mark. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library). Updated by Jill (Grenon) McMurry, 6/2012.

MEASURE 1-14 EXTENT AND MAGNITUDE OF HUMAN-CAUSED STREAM BANK EROSION

Definition This measure inventories number and severity of human-caused stream bank erosion points for water bodies adjacent to the HPBH WSA trail system.

Context During 2011, teams from the University of Montana's Wilderness Institute collected wilderness character monitoring data within the HPBH WSA. These teams documented erosion events along HPBH water bodies that were a result of recreational use. Crews did not monitor erosion mediated by uncontrolled trailside run-off. Impacted areas were categorized by landform as a stream, spring, wetland, pond, or lake. The width of streams was measured at bank height. For wetlands, ponds, and lakes, size was estimated in acres. For each impacted water body, erosion severity was categorized as slight, moderate, or severe. Summary definitions for erosion severity are provided below (see Noson and Filardi 2011 for details).

Slight: Entry to stream channel shows signs of bank instability, but most of the bank and trail integrity is intact. Erosion of the trail entry and streambank scour is minimal. Channel width is less than twice natural channel width. Lake or pond shore shows some disturbance, but bank form and function are still intact. Disturbance is less than 20 linear feet.

Moderate: Entry to stream channel shows moderate erosion or instability and tread is widened. Channel is more than twice the width of normal average channel width. Streamside vegetation outside of trailway is impacted. Stream channel width and characteristics return to normal within the distance of two natural channel widths downstream of trail edge. Lake or pond shore is disturbed and portions of the bank have sloughed off or collapsed. Disturbance is less than 20 linear feet.

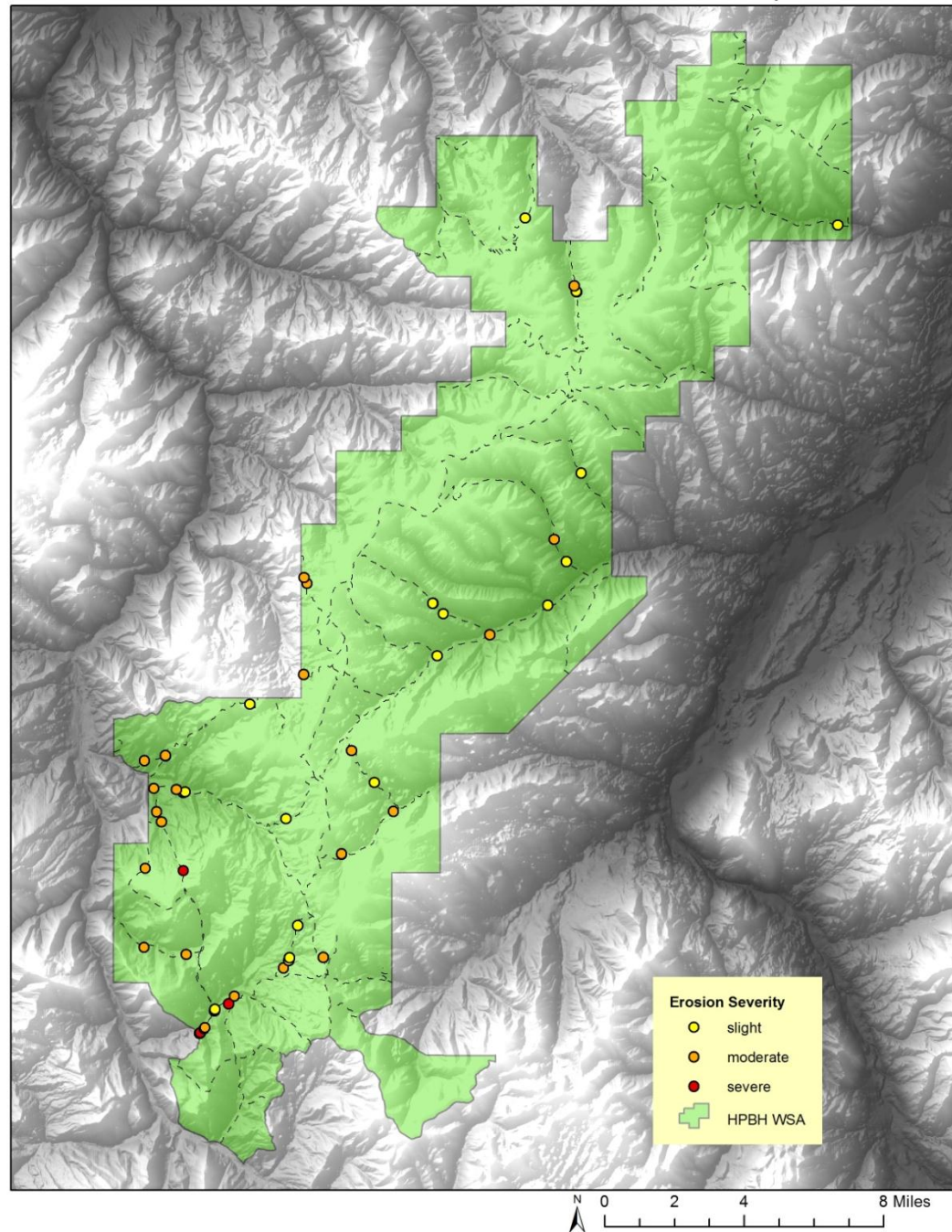
Severe: Entry to stream channel shows severe, active erosion. Stream channel is over twice natural width, and appears to be actively widening. The trail is more than three times normal width and/or has multiple eroded points of entry. Streamside vegetation is impacted and large areas of sod and soil are missing. Stream channel width and characteristics return to normal in excess of the distance of three natural channel widths downstream of trail edge. Lake or pond shore shows signs of heavy use and most of the bank has sloughed off or collapsed. Disturbance is greater than 20 linear feet.

Relevance	Human-caused stream bank erosion negatively impacts water processes, nutrient cycling, and soil retention. Increased erosion can also impact water body-residing species and plant species that colonize stream banks. As the number of water bodies categorized as severely eroded increases, the natural quality of wilderness character is degraded.
Data Source	Data were obtained from the Wilderness Institute's report on field measures of wilderness character in the HPBH WSA (Noson and Filardi 2011).
Data Adequacy	Wilderness Institute survey efforts in 2011 included erosion events along water bodies encountered while traversing all system and non-system trails. Water bodies away from trail systems were not evaluated, nor were absence data noted for water bodies without evidence of erosion.
Recent trend(s)	Human-caused stream bank erosion was not monitored prior to 2011.
2011 Baseline	Fifty water bodies with signs of recreation-derived erosion were documented. 6%, 46%, and 48% of these were rated severe, moderate, and slightly eroded, respectively (Table 10, Figure 12).

Table 10. Erosion severity by water body type

Waterbody type	Erosion severity		
	Slight	Moderate	Severe
Spring	1	2	0
Stream	20	19	3
Wetland	3	2	0
Total	24	23	3

Figure 12. Human-caused erosion sites and severity, 2011



Significant Change TBD

Monitoring Frequency Every five years

References Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

MEASURE 1-15 ASSESSMENT OF OVERALL STREAM WATER QUALITY

Definition	An assessment of overall stream water quality within the HPBH WSA.
Context	Water quality within the HPBH WSA is generally considered of high quality and several drainages produce water for the city of Bozeman (Sourdough/Bozeman Creek and Hyalite). The assessment provided for this measure relies on the professional judgment of water specialists on the Gallatin National Forest staff, given that there is no regularly occurring water sampling done within the WSA.
Relevance	A decline in HPBH WSA water quality indicates a degradation of physical resources and the natural quality of wilderness character.
Data Source	<p>Gallatin National Forest staff do not regularly perform water sampling in the HPBH WSA. The Gallatin National Forest hydrologist, however, is responsible for tracking indicators of water quality across the forest and is equipped to provide a professional narrative for this measure.</p> <p>In addition, the City of Bozeman monitors water quality for its water sources and publishes a yearly 'Water Quality Report' that assesses water quality within several drainages that supply the Hyalite Reservoir: (http://www.bozeman.net/Smarty/files/af/afacca46-5517-4115-8dd2-a5681a2653b8.pdf).</p>
Data Adequacy	The City of Bozeman monitors water quality at points of collection. These collection points occur outside the WSA boundary, but contain water that originates from drainages within the HPBH WSA.
Recent Trend(s)	<p>Water quality has historically been high. 2009 and 2010 City of Bozeman reports indicated that water from the Hyalite/Sourdough source met allowed levels for all detected contaminants, except lead and copper. The presence of lead and copper is regulated over the entire distribution system and not by source. Lead and copper presence was not attributed to the water source, but instead resulted from materials used in plumbing components across the distribution system, and does not indicate that HPBH WSA water is contaminated with either metal.</p> <p>Several wildfires in the last decade have had negative impacts on water quality within the WSA. The Fridley wildfire of 2001 and the Big Creek fire of 2006 resulted in accelerated sediment levels in West Pine Creek and Eightmile Creek in 2001 and Big Creek and Fridley Creek in 2007. These increases in sediment generally last one to five years after a wildfire, and diminish as watersheds have sufficient recovery of grass, shrubs, and forbs to stabilize erosion on hillsides.</p>
2011 Baseline	<p>Mark Story, Gallatin National Forest hydrologist, provided the following professional assessment of water quality for the HPBH WSA:</p> <p>"Water quality data within the HPBH is extremely limited but can be estimated based on water quality data from streams flowing out of the HPBH, such as Hyalite Creek, South Cottonwood Creek, Storm Castle Creek, South Rock Creek, Tom Minor Creek, and Big Creek. The HPBH is dominated by Tertiary Volcanic parent material which is moderate in sediment levels but low in nutrients. Streams below the HPBH boundary generally have good to excellent water quality to the Gallatin Forest boundary, with the primary degradation due to historical road building and timber harvesting, wildfires, and localized grazing and recreational impacts."</p>

In 2011, the City of Bozeman reported that water from the Hyalite/Sourdough source met allowed levels of detected contaminants for all contaminants except lead and copper.

Significant Change TBD

Monitoring Frequency Every five years

- References
- City of Bozeman Water Treatment Plant. 2009. Water Quality Report. City of Bozeman, Bozeman, MT.
 - City of Bozeman Water Treatment Plant. 2010. Water Quality Report. City of Bozeman, Bozeman, MT.
 - City of Bozeman Water Treatment Plant. 2011. Water Quality Report. City of Bozeman, Bozeman, MT.
 - Story, Mark. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library). Updated by Jill (Grenon) McMurry, 6/2012.

Monitoring Question: What are the trends in terrestrial, aquatic, and atmospheric natural processes inside this WSA?

Indicator **Biophysical Processes**

MEASURE 1-16 PERCENTAGE OF WSA IN FIRE REGIME CONDITION CLASS TWO OR THREE

Definition	Percent of acres within the HPBH WSA identified as being in fire regime condition class two or three.
Context	<p>A fire regime condition class two (FRCC2) or three (FRCC3) indicates fire frequencies for an area have departed from historical frequencies by more than one return interval (moderate or high departure respectively; either increased or decreased).</p> <p>There have been 73 detected wildland fires within the HPBH WSA since the mid-1940s. The emphasis on suppressing fire, as directed in the 1987 Gallatin Forest Plan, has increased the acres within the WSA in condition classes two or three.</p>
Relevance	Departures from historical fire frequencies as a result of anthropogenic suppression degrade the natural quality of wilderness. They also indicate an increased wildfire risk and a higher likelihood of exceeding historical fire severity and extent, which can further degrade the natural quality of wilderness by altering wildlife and plant habitats and impacting human recreation experiences.
Data Source	Data was compiled from the following sources: Hann et al. 2004, updated 2008; Vegetation Condition Class and Fire Regime Condition Class (FRCC) analyses derived from Landfire 2008 Rapid Refresh and the FRCC Mapping Tool 2.2.0 v.
Data Adequacy	Fire frequency for the Gallatin Mountain Range was determined using <i>Fire Ecology of Montana Forest Habitat Types East of the Continental Divide</i> (Fischer and Clayton 1983), the guiding document for estimating historical fire occurrence, type, and frequency in forested habitats

throughout the northern ranges of the Greater Yellowstone Area. Procedures outlined in the *Interagency Fire Regime Condition Class Guidebook* (Hann et al. 2004, updated 2008), have been used to determine and map fire regime condition classes through the Northern Region of the Forest Service, along with other western regions. The FRCC Mapping Tool 2.2.0 combines Hann et al. (2004, updated 2008) with LANDFIRE 2008 Rapid Refresh (LANDSAT imagery). All these sources, combined with professional knowledge of the current vegetation condition, fire types, and local fire history, were used to analyze the vegetative landscapes and associated fire behavior of the Gallatin Mountain Range, which envelops the HPBH WSA.

Recent trend(s) Fires have been actively suppressed in the HPBH WSA since the 1987 Gallatin Forest Plan went into effect, but were likely suppressed in the WSA for half a century or more prior to this. As a result, it is assumed that fire frequencies have increasingly departed from historical frequencies during the last century. The forest habitat vegetation types in the HPBH WSA have moderately long fire return intervals (ranging from 35 to over 200 years) that generally burn in large patch sizes. It is not unusual for large-scale, mixed severity, stand-replaced fire events to occur in these forested landscapes within the Gallatin Mountain Range.

2011 Baseline Based on FRCC Mapping Tool 2.2.0, as of 2011, approximately 75% of the HPBH WSA is in FRCC2 and FRCC3. (56% of the HPBH WSA is in FRCC2 and 19% of the HPBH WSA is in FRCC3.)

The 2011 analysis indicated that in comparison to reference conditions, the current vegetation condition exhibits an excess of mid-seral and late-seral open forest types, constituting 67% of total HPBH WSA acreage. An additional 17% of the WSA contains late-seral, closed canopy forest with a surplus of lodgepole pine/subalpine fir and Engelmann spruce/subalpine fir forests compared to historic reference conditions. This, however, does not necessarily equate to a departure from the historical reference condition and may or may not reflect influences on fire frequency.

Significant Change TBD

Monitoring Frequency Every five years

References Fischer, W.C.; Clayton, B.D. 1983. Fire ecology of Montana forest habitat types east of the Continental Divide. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station General Technical Report INT-141.

Hunter, L.; Jones, J.; Zeiler, J.D. 2007. Fire Regime Condition Class (FRCC) Mapping Tool for ArcGIS 9.0-9.3 (version 2.2.0). National Interagency Fuels Technology Team. Available online: <http://www.frcc.gov>

Hann, W.; Shlisky, A.; Havlina, D.; Schon, K.; Barrett, S.; DeMeo, T.; Pohl, K.; Menakis, J.; Hamilton, D.; Jones, J.; Levesque, M.; Frame, C. 2004. Interagency Fire Regime Condition Class Guidebook. Last update, January 2008: Version 1.3.0. *Available online*. [Homepage of the Interagency and The Nature Conservancy Fire Regime Condition Class website, USDA Forest Service, US Department of the Interior, The Nature Conservancy and Systems for Environmental Management].

LANDFIRE 2008 Rapid Refresh – source for biophysical setting data and succession class data.

Shea, Julie. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library).

SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION QUALITY

The Wilderness Act states that wilderness has “outstanding opportunities for solitude or a primitive and unconfined type of recreation.” This quality captures the *opportunity* for people to experience wilderness and is not directly about visitor experiences per se. This quality is degraded by settings that reduce those opportunities, such as visitor encounters, signs of modern civilization, recreation facilities, and management restrictions on visitor behavior.

Monitoring Question: What are the trends in outstanding opportunities for solitude inside this WSA?

Indicator Remoteness from sights and sounds of people inside the WSA

MEASURE 2-1 TOTAL ESTIMATED SITE VISITS

Definition	The annual visitation estimate for the HPBH WSA.
Context	<p>Gallatin County population growth has had a direct effect on Gallatin National Forest visitation rates, including the HPBH WSA. Between 2000 and 2010, there was a 32% increase in the Gallatin County population (67,831 to 89,513). Over the same period, Park County population remained stable (15,694 to 15,636). Both Gallatin and Park Counties surround portions of the HPBH WSA. The city of Bozeman is in Gallatin County and Livingston is in Park County. The increase in local residents, plus continued popularity of the region as a tourist destination, has impacted annual HPBH WSA visitation rates.</p> <p>This measure captures overall trends in visitor use numbers, and relies exclusively on data collected via the National Visitor Use Monitoring (NVUM) program. NVUM provides reliable information about recreation visitors to national forest system managed lands and generates science-based information about the type, quantity, quality, and location of recreation use on public lands. This measure relies on annual visitation estimates reported by NVUM, and does not distinguish between different types of users.</p>
Relevance	As the total estimated number of site visits increases the opportunities for solitude quality of wilderness character is degraded.
Data Source	<p>NVUM methodology and analysis is explained in detail in English et al. 2001. (http://www.fs.fed.us/recreation/programs/nvum).</p> <p>In simplest terms, visitation is estimated through a combination of traffic counts and surveys of existing visitors. Both are obtained on a random sample of locations and days distributed over a year.</p>
Data Adequacy	The NVUM process is generally designed to be valid and applicable at the forest, regional, and national level. It is not designed to be accurate at the district or subunit level. When Gallatin National Forest NVUM sampling was completed in fiscal year (FY) 2009, forest staff requested a stand-alone sample, visitation estimate, and visit description analysis for the HPBH WSA, with adequate sampling to estimate use at that landscape level. This modified protocol increased the number of samples collected for the HPBH WSA to provide statistically valid data for this area. If future sampling continues to utilize this sample design, highly reliable data for the HPBH WSA will continue to be available.

The FY 2009 annual visitation estimate (below) was based on a sample size of 747 interviewed individuals, 263 of who were last exiting recreation (i.e. finishing a recreation visit sometime during the interview day).

Recent Trend(s) Pre-FY 2009 NVUM data is not available.

2011 Baseline The FY 2009 NVUM annual visitation estimate for the HPBH WSA was 105,900 site visits with a 90% confidence interval width of 34.5%.

Significant Change TBD

Monitoring Frequency Every five years. The next NVUM sampling will occur in 2014.

References English, D. B.; Kocis, S. M.; Zarnoch, S. J.; Arnold, J. R. 2001. Forest Service National Visitor Use Monitoring Process: Research Method Documentation. USDA Forest Service Southern Research Station.

Forstall, R. L. 1995. Population of Counties by Decennial Census: 1900 to 1990. U.S. Bureau of the Census, Population Division. Washington, D.C.
(<http://www.census.gov/population/cencounts/mt190090.txt>)

US Census Bureau. Gallatin County QuickFacts.
(<http://quickfacts.census.gov/qfd/states/30000.html>)

USDA Forest Service Region 1. 2010. National Visit Use Monitoring Results: Gallatin National Forest and Hyalite Porcupine Buffalo Horn WSA.

MEASURE 2-2 PROPORTION OF TRAIL CONTACTS IN HIGH USE CORRIDORS

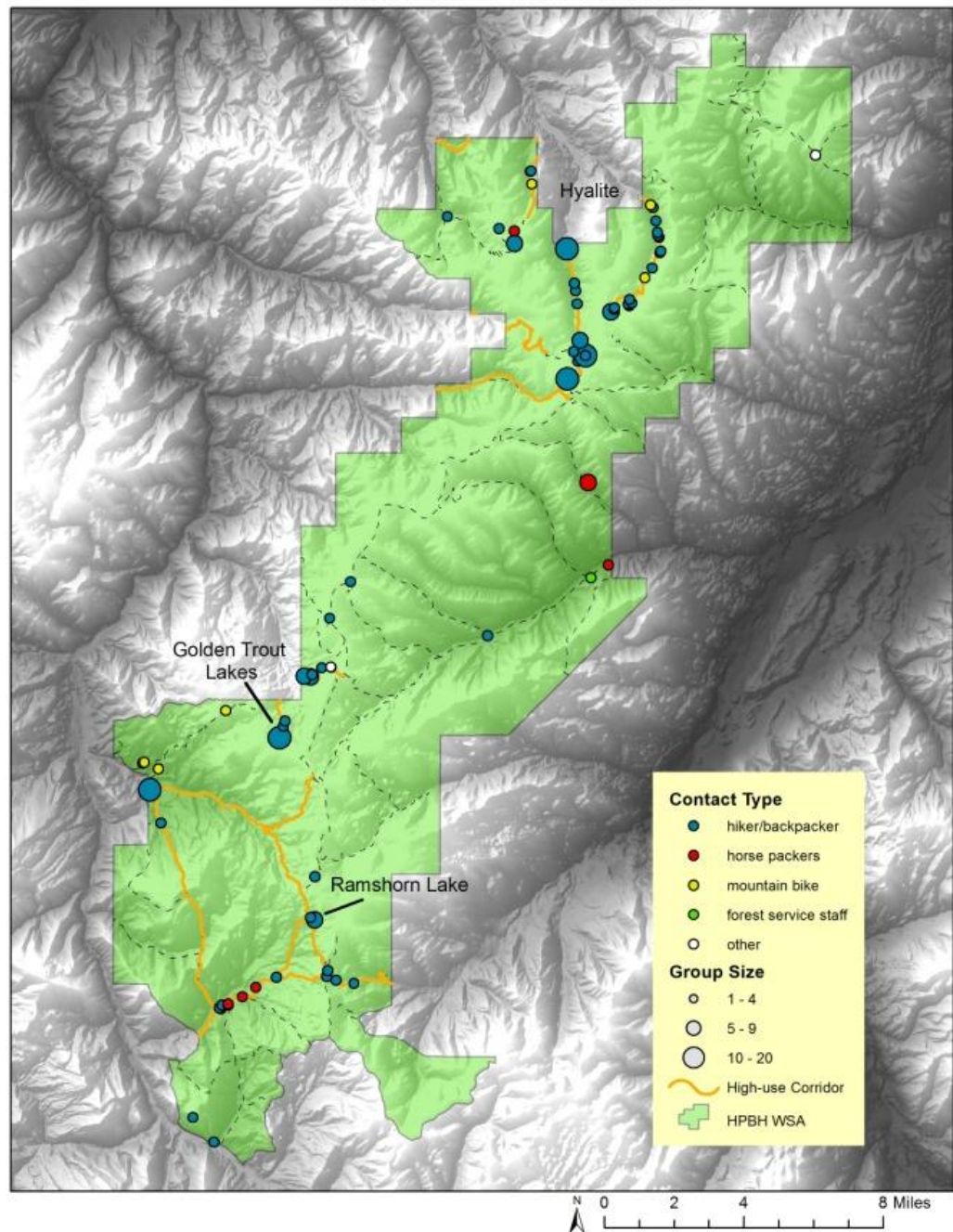
Definition The proportion of recorded trail contacts that occurred in high-use corridors. High-use corridors are defined as trails in development classes four and five (see Measure 2-8), as well as popular one-way trails to mountain lakes in the moderate-use trail-class designation (e.g. Heather and Golden Trout Lakes).

Context The Hyalite-Porcupine Wilderness Study Report (USDA 1985), indicated that the WSA received about 45,000 recreation visitor days of use annually, with the highest concentration of recreation use likely occurring in the Hyalite Peaks area. Unit plans from 1974 indicated that heaviest use during that time period was in the Porcupine (1,000 visitors/year) and Buffalo Horn (>1,500 visitors/year) areas. These historic use figures were gross estimates with no statistical validity, and cannot be compared with any current metrics, such as site visits from the National Visitor Use Monitoring data displayed in Measure 2-1.

The 1985 Report also concluded that “the experience of solitude is difficult to achieve on major trails or the most popular campsites during warm months because of the popularity of the areas. Solitude can be achieved by seeking out less frequented areas...Opportunities for solitude is high in most of the Gallatin Range except in frequented areas like trail junctions, popular camping sites or the better fishing lakes” (USDA 1985).

Relevance	An increase in the percentage of contacts occurring in low and medium use corridors will indicate a degradation of the opportunities for solitude quality of wilderness character.
Data Source	The 2011 University of Montana's Wilderness Institute monitoring crews recorded all encounters with people on trails throughout the field season. Both the number of people and the type of activity (hiker/backpacker, mountain bike, horse, ATV, motorbike, UTVs, or Forest Service staff) was documented (Noson and Filardi 2011).
Data Adequacy	Data are based on a single-pass survey and do not provide a statistically adequate sample. Available data provide only a snapshot of trail use and contacts, and future sample efforts should adopt a more rigorous method. A more robust sampling protocol is being drafted by members of the Forest Service Wilderness Information Steering Committee. In the future, this measure will likely be redefined to reflect trends in the average number of encounters within individual trail development classes.
Recent Trend(s)	Data was not collected prior to 2011 surveys and trends cannot yet be assessed.
2011 Baseline	During Wilderness Institute monitoring efforts, 292 people were encountered with 227 (78%) encountered in high-use corridors. This data, collected during a single-pass survey of all trails within the HPBH WSA on 20 days between July 4 and October 2, 2011, suggests that opportunities for solitude are high outside of high-use corridors.

Figure 13. Trail contacts and group sizes, 2011



Significant Change TBD

Monitoring Frequency Every five years

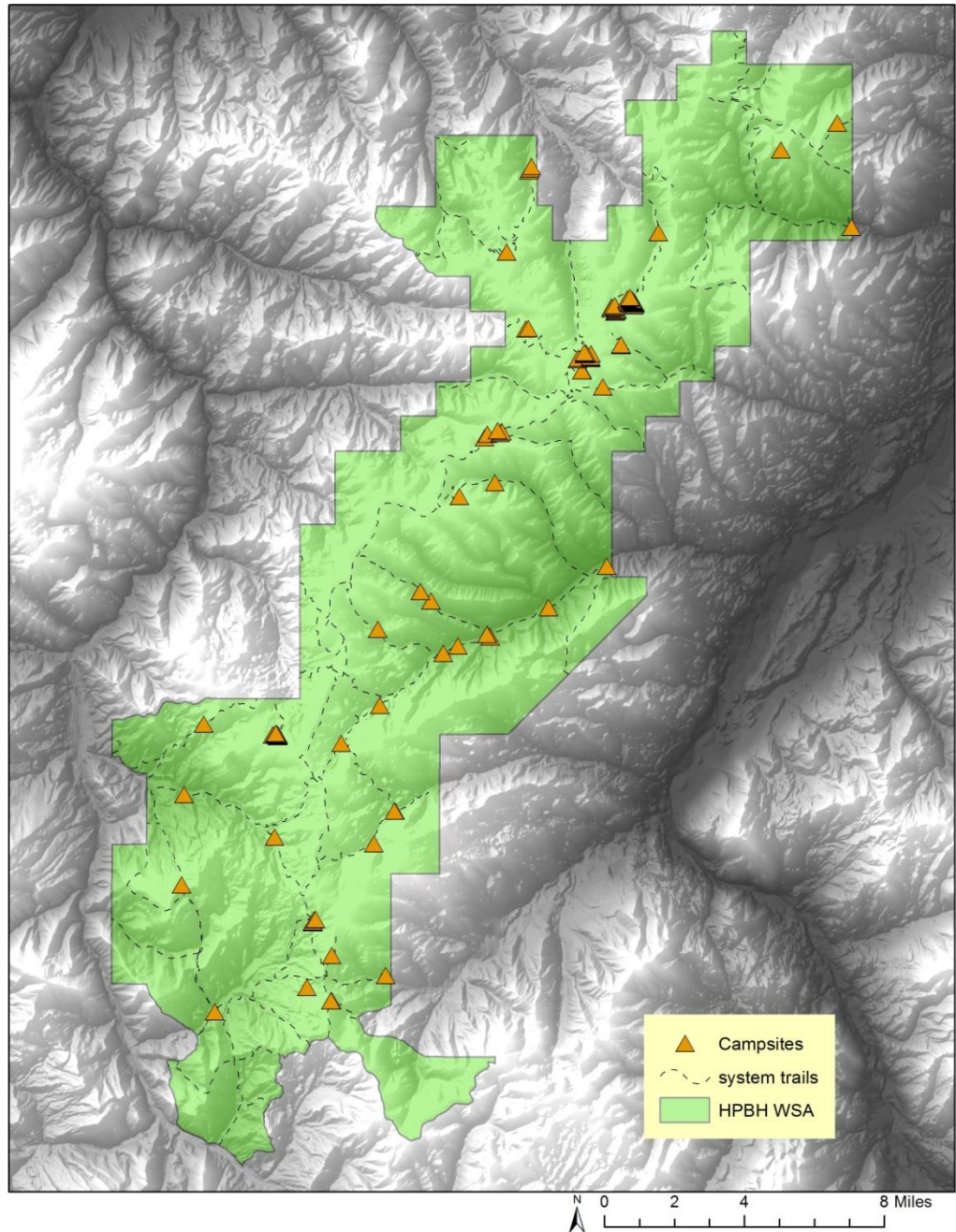
References Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

MEASURE 2-3 CAMPSITE INDEX

Definition	This additive index reflects campsite conditions and number of campsites. The index is sensitive to fluctuations in impact levels and total number of campsites.
Context	<p>Recreation site monitoring, most often applied to campsites, is the systematic collection and evaluation of site inventory and condition data to establish a baseline and/or identify changes and trends over time. Recreation site monitoring helps ensure that opportunities for wilderness experiences are preserved while adverse impacts to the biophysical components of the wilderness resource are minimized. The primary purpose of recreation site monitoring is to provide essential information for identifying and minimizing the biophysical and social impacts of these sites. A completed recreation site inventory is one component of the Chief's 10-year Wilderness Stewardship Challenge, and as a result, standardized protocols for conducting these inventories are readily available (see wilderness.net).</p> <p>Most campsites within the HPBH WSA are clustered around lakes, with 25% at Heather and Emerald Lakes, 11% near Hyalite Lake, 11% near Golden Trout Lakes, and 5% at Crater Lake.</p>
Relevance	While campsites are a type of development, research has also shown that recreationists feel a loss of solitude when encountering others in a camp setting (Cole and Hall 2009). Increases in the campsite index value reported for this measure degrade the opportunities for solitude quality of wilderness character.
Data Source	University of Montana Wilderness Institute monitoring efforts included a campsite inventory for the HPBH WSA, conducted in July and August 2011 (Noson and Filardi 2011). An index for each campsite was calculated following generalized Forest Service protocols Appendix B). Index attributes included 1) vegetative loss; 2) mineral soil exposure; 3) damage to trees; 4) number of trees with exposed roots; 5) the type and number of developments; 6) cleanliness; 7) the number of social trails; 8) camp area, and 9) barren core camp area. Ratings assigned to individual impact attributes were weighted and combined to generate a summary impact index score for each campsite. Scores for all campsites were added together to calculate the final campsite index score for the HPBH.
Data Adequacy	<p>Fifteen out of 105 campsites were missing data for one or more impact attribute and were assigned the average impact score for campsites with complete data.</p> <p>Wilderness Institute protocols used slightly different estimated camp area sizes than standard forest service protocols. As a result, no campsites received the highest impact rating for camp areas >2,000 ft² although some may have warranted this rating.</p> <p>When campsites are resurveyed, the same protocols and index calculations need to be used to ensure future data comparability and trend detection (Appendix B).</p>
Recent trend(s)	2011 was the first year that detailed data was collected and a campsite index value was generated, so inferences about trends cannot yet be made.
2011 Baseline	The 2011 campsite index score is 3,233. This value is the sum of calculated scores for all 105 sampled campsites (see Appendix B).

In summary, of the 105 sampled campsites, 19% were minimally impacted, 53% were moderately impacted, and 27% were highly impacted. One campsite, located on a non-system trail, was extremely impacted (see Noson and Filardi 2011 for further detail).

Figure 14. Campsites, 2011



Significant Change TBD

Monitoring Frequency Every five years

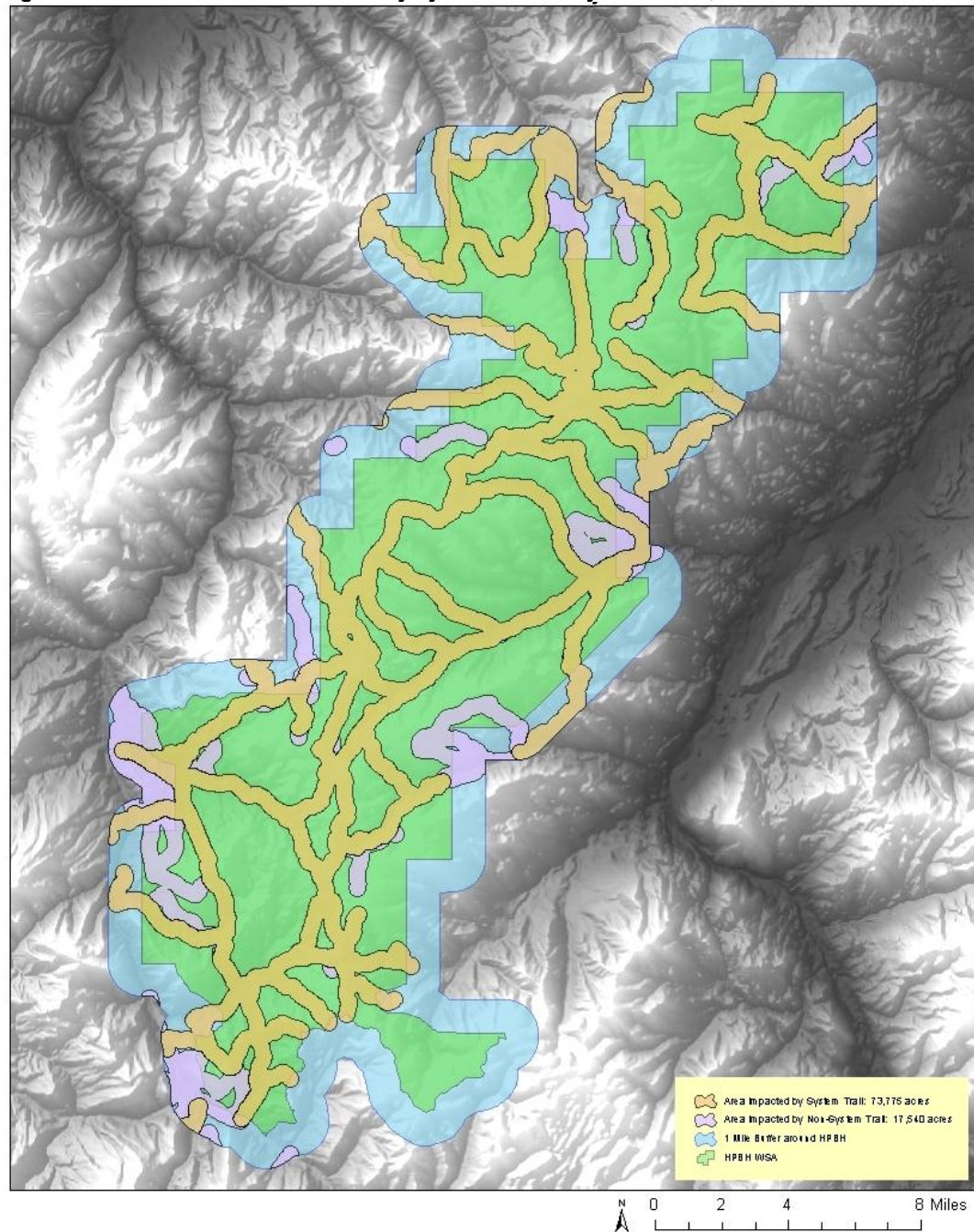
References Cole, D. N.; Hall, T. 2009. Perceived effects of setting attributes on visitor experiences in wilderness: variation with situational context and visitor characteristics. *Environmental Management*. 44: 24-36.

Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

MEASURE 2-4 ACRES AFFECTED BY TRAVEL OR ACCESS ROUTES WITHIN WSA

Definition	Acres within the HPBH WSA where opportunities for solitude are impacted by proximity to system or non-system trails. Acres within ¼ mile of system or non-system trails are considered impacted.
Context	Guidelines from Landres et al. (2009), were used to establish the buffering distances surrounding access and travel routes likely to have meaningful negative effects on opportunities for solitude.
Relevance	As the number and length of trails within the HPBH WSA increases there will be a corresponding degradation of the opportunities for solitude quality of wilderness character.
Data Source	Trail data was obtained from the Gallatin National Forest GIS library, which included Wilderness Institute survey efforts (Noson and Filardi 2011). ArcGIS was used to calculate impacted area.
Data Adequacy	Data reflects current known system and non-system trails. University of Montana Wilderness Institute crews surveying the HPBH WSA in 2011 were unable to completely survey all non-system trails due to field time constraints. Thus the reported 2011 acreage is a minimum calculation of the true impacted acres. ArcGIS calculations of acreage are highly accurate.
Recent trend(s)	No new system trails have been established in the last five years. In 2011, monitoring crews from the University of Montana Wilderness Institute identified and mapped 109 previously unidentified trails that were 5.8 miles in combined length (Noson and Filardi 2011; see Data Adequacy caveat above).
2011 Baseline	In 2011, 91,315 acres were affected by access or travel routes within the HPBH WSA. System trails affected 73,775 acres and non-system trails affected 17,540 acres.

Figure 15. Area within WSA affected by system or non-system trails, 2011



Significant Change TBD

Monitoring Frequency Every five years

References Landres, P.; Boutcher, S.; Dean, L.; Hall, T.; Blett, T.; Carlson, T.; Mebane, A.; Hardy, C.; Rinehart, S.; Merigliano, L.; Cole, D. N.; Leach, A.; Bumpus, D. 2009. Technical guide for monitoring selected conditions related to wilderness character. Gen. Tech. Rep. RMRS-GTR-WO-80. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

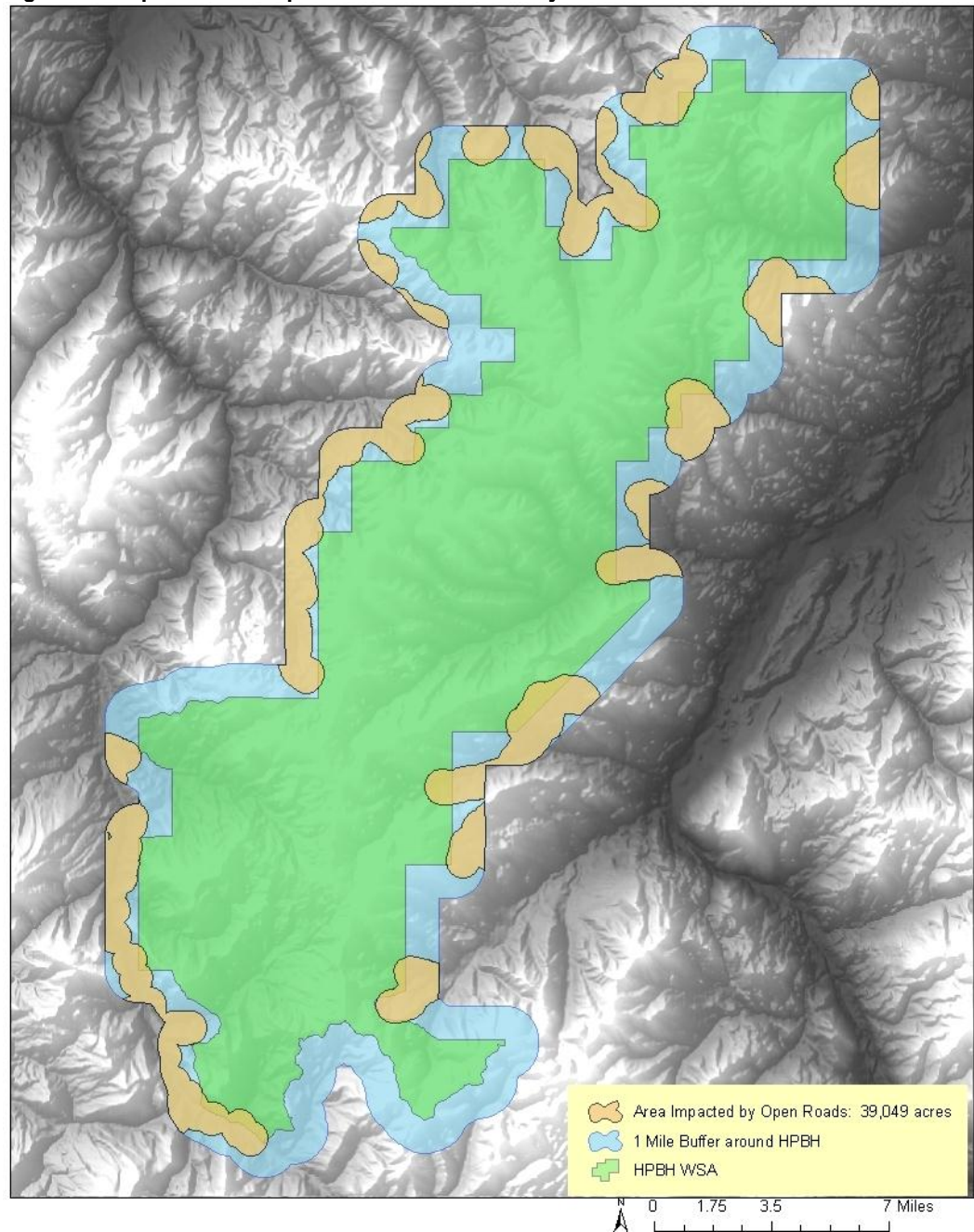
Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

Indicator ***Remoteness from occupied and modified areas outside the WSA***

MEASURE 2-5 ACRES WITHIN WSA AFFECTED BY TRAVEL ROUTES OUTSIDE AREA

Definition	Acres within the HPBH WSA where solitude is impacted by proximity to open roads used by motor vehicles within one mile of the WSA boundary.
Context	Guidelines from Landres et al. (2009) suggest open roads used by motor vehicles within ½ mile of the area boundary likely have meaningful negative impacts on wilderness character. To determine the acreage for this measure a one mile buffer was placed around the HPBH WSA boundary and all open roads within that buffer were considered to have an impact up to ½ mile away.
Relevance	As the number, proximity, and length of roads within one mile of the HPBH WSA boundary increases, there will be a corresponding degradation of the opportunities for solitude quality of wilderness character.
Data Source	Data was obtained from the Gallatin National Forest GIS library and ArcGIS was used to calculate acreage.
Data Adequacy	Data reflects current open roads. There is high confidence that all roads have been identified and properly mapped. ArcGIS calculations of acreage are highly accurate.
Recent trend(s)	No new roads have been built within one mile of the WSA boundary in the last five years.
2011 Baseline	In 2011, 39,049 acres of the HPBH WSA and surrounding buffer area were affected by open roads used by motor vehicles.

Figure 16. Impact area of open roads in WSA vicinity



Significant Change TBD

Monitoring Frequency Every five years

References Landres, P.; Boutcher, S.; Dean, L.; Hall, T.; Blett, T.; Carlson, T.; Mebane, A.; Hardy, C.; Rinehart, S.; Merigliano, L.; Cole, D. N.; Leach, A.; Bumpus, D. 2009. Technical guide for monitoring selected conditions related to wilderness character. Gen. Tech. Rep. RMRS-GTR-WO-80. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Monitoring Question: What are the trends in outstanding opportunities for primitive and unconfined recreation inside this WSA?

Indicator **Facilities that decrease self-reliant recreation**

MEASURE 2-6 NUMBER OF AGENCY-PROVIDED RECREATIONAL FACILITIES AND DEVELOPMENTS

Definition	The number of agency-provided or maintained recreational facilities and developments within the HPBH WSA. Examples of facilities include bridges, latrines, cabins, cairns, hitching posts, and trails.
Context	<p>Surveys have indicated that recreational use of Hyalite Canyon and the HPBH WSA has significantly increased over the last several decades as the population of Gallatin County has grown (Schlenker 2003). In order to limit recreational impacts and facilitate recreational use of the HPBH, the Forest Service and Montana Fish, Wildlife, and Parks provide a number of recreational facilities and developments within the WSA.</p> <p>There is one recreational cabin in the HPBH WSA, the Windy Pass Cabin, and it has been a part of the cabin rental program since 1991. In 2003, the cabin was rented an average of 77 nights per year with an average party size of 3.5 people (approximately 270 visitors a year).</p> <p>Non-recreational physical installations and developments, both authorized and unauthorized, are addressed in a separate set of measures (Measure 3-1 and Measure 3-2).</p>
Relevance	The creation and maintenance of recreational facilities and developments by the agency reduces opportunities to use primitive skills and natural physical abilities. An increased number of facilities and developments degrades the opportunities for primitive and unconfined recreation quality of wilderness character.
Data Source	University of Montana Wilderness Institute's field crew conducted an inventory of agency-provided recreational facilities and developments as they surveyed system and non-system trails across the HPBH WSA during the summer of 2011 (Noson and Filardi 2011).
Data Adequacy	Wilderness Institute crews surveyed visible developments from virtually all system trails, and the majority of non-system trails in the HPBH WSA. When possible, data was cross-checked with existing forest records and with Schlenker (2003). Forest staff were consulted to verify whether certain questionable features were agency-provided or user-created.
Recent Trend(s)	The number of agency-provided recreation facilities and developments has been relatively stable over the last decade, with the most fluctuation likely in the number of minor trail features and signs. Trail maintenance activities happen on a yearly basis and may include bridge replacements and water bar installations. In 2011, the Windy Pass latrine was reconstructed.
2011 Baseline	In 2011, there were 291 agency-provided recreational facilities and developments and 204 miles of agency-provided, system trails (see Table 11 for breakdown).

Table 11. Agency-provided recreational facilities and developments

Type of facilities or development	Quantity
Bridges	10
Cabins	1
Cairns	34
Campsites	0
Corrals	1
Fences	1
Hitching posts	1
Latrines	2
Minor trail features	92
Miles of system trail	204
Picnic tables	1
Signs	148

Significant Change TBD

Monitoring Frequency Every five years

References Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

MEASURE 2-7 NUMBER OF USER-CREATED RECREATION FACILITIES

Definition	The number of user-created recreation facilities present in the HPBH WSA. Examples of user-created facilities include bridges, corrals, hitching posts, signs, and trails.
Context	Surveys have indicated that recreational use of Hyalite Canyon and the HPBH WSA has significantly increased over the last several decades as the population of Gallatin County has grown (Schlenker 2003). Despite regulations that prohibit user-created facilities (36 CFR 261.10), recreational users sometimes choose to develop facilities within the WSA to navigate obstacles, enhance their recreational experience, or communicate messages to other recreationists.
Relevance	User-created recreation facilities detract from the WSA's naturalness and reduce opportunities to rely on primitive skills and physical abilities. As the number of user-created facilities increases the opportunities for primitive and unconfined recreation quality of wilderness character is degraded.
Data Source	University of Montana Wilderness Institute's field crews conducted an inventory of user-created recreational facilities and developments as they surveyed system and non-system trails across the HPBH WSA during the summer of 2011 (Noson and Filardi 2011).
Data Adequacy	Wilderness Institute crews did not survey off-trail areas in the HPBH WSA, so user-created facilities and trails located away from system and non-system trails may have been overlooked. Forest staff were consulted to verify whether questionable features (certain bridges, signs, corrals,

etc.) were agency-provided or user-created. The miles of user-created routes in the 2011 baseline (below) are likely under represented.

Recent Trend(s) An inventory of user-created recreation facilities was compiled for the first time by Wilderness Institute field crews during the summer of 2011, so recent trends are unknown.

2011 Baseline In 2011, there were 12 user-created recreational facilities and 52.9 miles of non-system, user-created trails (see Table 12 for breakdown).

Table 12. User-created recreational facilities

Type of facilities or development	Quantity
Bridges	2
Corrals	1
Hitching posts	3
Miles of non-system trail	52.9
Pole stashes	2
Shelters	1
Signs	3

Significant Change TBD

Monitoring Frequency Every five years

References Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

MEASURE 2-8 TRAIL MILES IN DEVELOPED CONDITION CLASSES 3 TO 5

Definition The total number of trail miles within the HPBH WSA that are developed or improved (condition class 3), highly developed (condition class 4), and fully developed (condition class 5).

Context Trails within the HPBH WSA are maintained on a regular basis. Almost all trails are open to stock use, though some trails are more suited to this type of use than others. Over the past 25 years, heavy maintenance and reconstruction have improved some trails within the WSA. User-built trails are undesirable and have been rehabilitated whenever possible. System trails within the HPBH WSA are categorized into one of five National Trail Management Condition Classes (see Table 13 below). This classification reflects the desired future condition for all trails, and the existing condition for most. This current inventory reflects travel management decisions made in 2006 (the final selected alternative) and may change slightly under a revised travel decision.

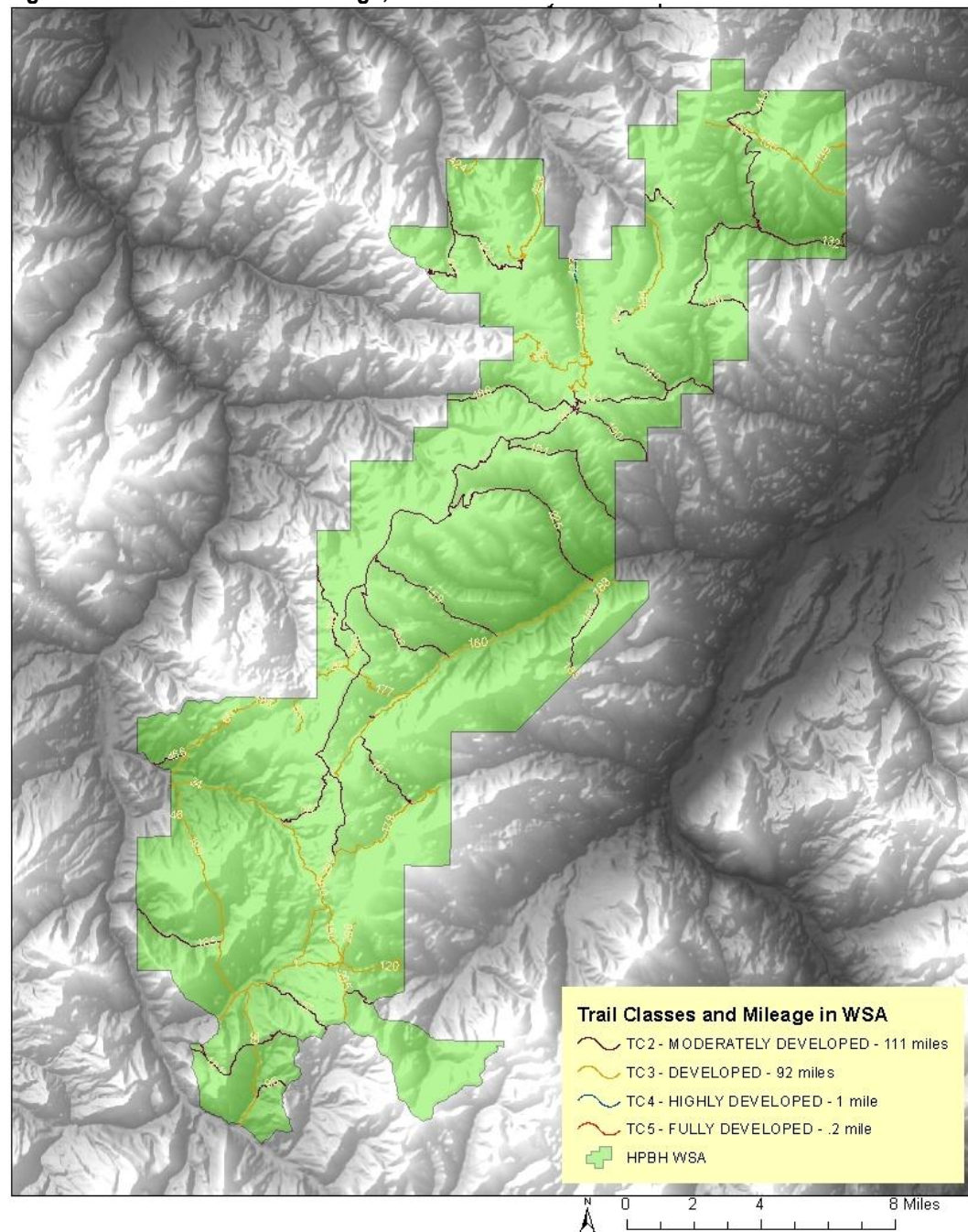
This measure tallies only mileage of trail within the HPBH WSA in condition classes 3 through 5.

Table 13. National trail management condition classes

Condition Class	Description
1	Minimally or undeveloped trail. Trail tread is intermittent and often indistinct. Obstacles are common. Minimal signage.
2	Simple or minorly developed trail. Trail tread is discernible and continuous, but narrow and rough. Obstacles are occasionally present. Structures are of limited size, scale, and number. Minimal signage as required for basic direction.
3	Developed or improved trail. Trail tread is obvious and continuous. Obstacles are infrequent. Trail structures are common and may be substantial. Signs are used to relay regulations, protect resources, and assure users.
4	Highly developed trail. Trail tread is wide and relatively smooth with few irregularities. There are few or no obstacles present. Structures are frequent and substantial. There may be a wide variety of signs present.
5	Fully developed trail. Trail tread is wide, firm, stable, and generally uniform. Obstacles are not present. Structures are frequent or continuous and are frequently constructed of imported materials. Signage is frequent and wide in variety.

Relevance	Developed trails reduce the primitive nature of an area, thereby decreasing the need for self-reliant route finding. An increased number of highly developed trail miles reduces the solitude and primitive recreation qualities of wilderness character.
Data Source	Data was accessed by Jonathan Kempff, Forest Engineer and Trails Program Manager for the Gallatin National Forest. Data is currently stored as an autocad spatial layer, but will be transferred into the corporate database (INFRA Trails) at some point in the future.
Data Adequacy	An accurate spatial layer exists within the Gallatin National Forest Engineering files. This dataset, however, reflects the Gallatin National Forest Travel Management Decision rescinded within the HPBH WSA boundary through litigation outcomes in 2009. A new travel management decision at some point may modify these trail management objectives, though the trail class is not likely to change significantly regardless of what type of uses are allocated to that specific trail.
Recent trend(s)	No significant developments of new, maintained, developed trail have occurred in the HPBH WSA in more than a decade.
2011 Baseline	As of 2011, there were 93.2 total miles of trail in developed condition classes 3, 4, and 5 in the HPBH WSA (92, 1, and 0.2 miles respectively; Figure 17).

Figure 17. Trail classes and mileage, 2011



Significant Change TBD

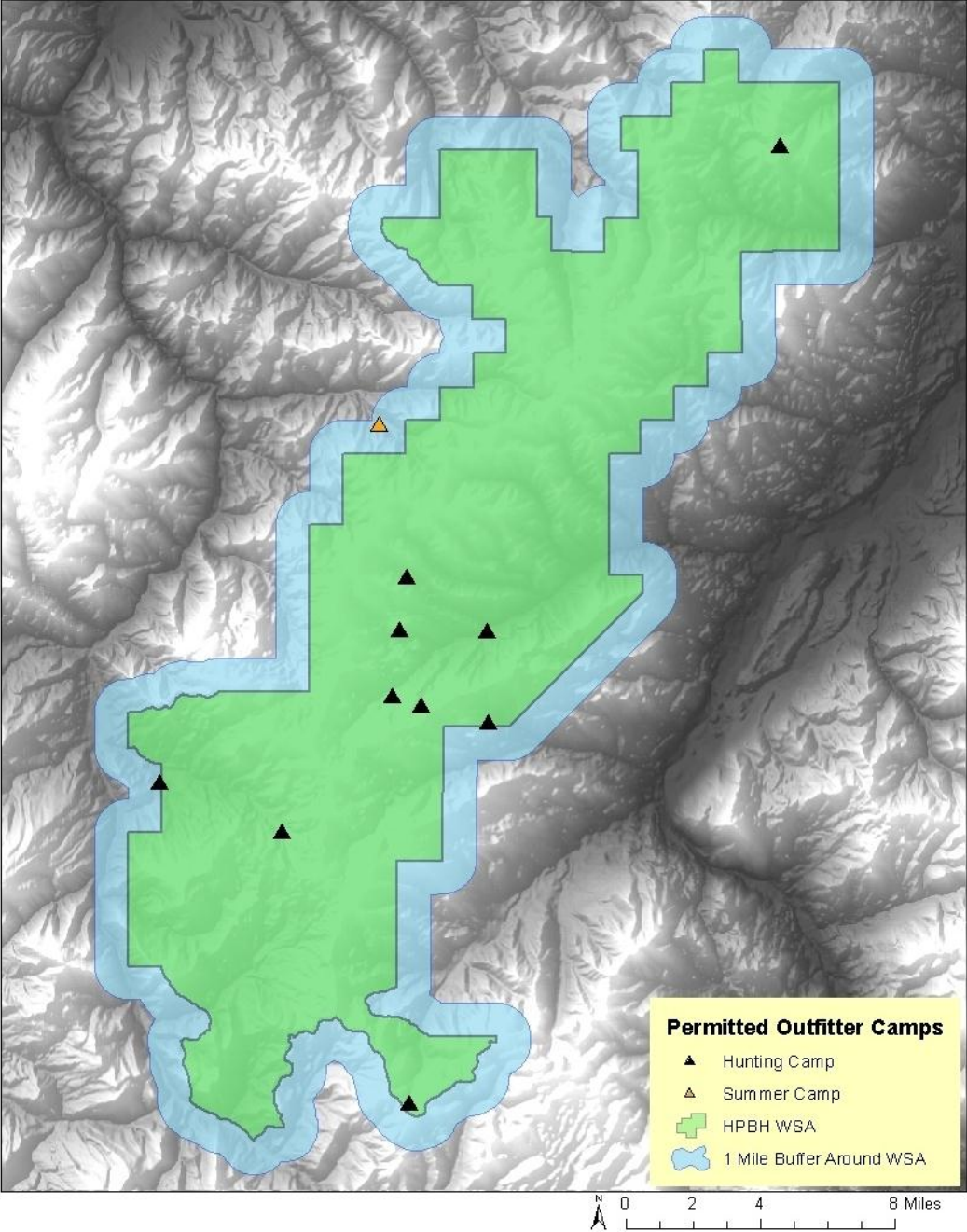
Monitoring Frequency Every five years

References Full description of National Trail Management Condition Classes available at:
[http://www.fs.fed.us/recreation/programs/trail-management/trail-fundamentals/National Trail Class Matrix 10 16 2008.doc](http://www.fs.fed.us/recreation/programs/trail-management/trail-fundamentals/National_Trail_Class_Matrix_10_16_2008.doc)

MEASURE 2-9 NUMBER OF OUTFITTER AND GUIDE ASSIGNED SITES

Definition	The total number of sites assigned to approved outfitters and guides for their commercial use.
Context	<p>The 1974 Unit Plan indicated that there were numerous outfitter camps in the HPBH WSA, located in Steel, Bark Cabin, Porcupine, and Buffalo Horn Creeks. At that time, permits were only issued to overnight hunting outfitters.</p> <p>In the late 1980s and early 1990s, all hunting outfitting, including day use, went under permit. In 1994, non-hunting outfitters, such as guided horseback rides, were also put under permit.</p> <p>Permits are issued to approved outfitters and guides for use of sites within the HPBH WSA once every ten years.</p>
Relevance	Visitors to the HPBH WSA using outfitter and guiding services are not self-reliant and depend on permanent or temporary facilities that outfitters have in place at assigned sites. An increase in the number of assigned sites reflects an increase in visitor use of outfitters and guides and a decrease in the opportunities for primitive and unconfined recreation quality of wilderness character.
Data Source	Data were obtained from the Gallatin National Forest Special Use Permit Records.
Data Adequacy	Permits for all assigned sites are kept on file by the Gallatin National Forest and are an accurate reflection of the number of outfitter and guide assigned sites.
Recent Trend(s)	Between the late 1970s and 2003, nine assigned sites were eliminated (Schlenker 2003). In 2003, there were 15 hunting camps (including several spike camps), which is five more than in 2011. This suggests a long-term declining trend in the total number of outfitter and guide sites.
2011 Baseline	In 2011, a total of 10 sites were used by three outfitters and guides. Six served as base camps and four were smaller, less developed spike sites. All 10 sites are used for hunting purposes. One assigned site contains significant developments, including a cache cabin and permanent corrals.

Figure 18. Outfitter and guide assigned sites, 2011



Significant Change TBD

Monitoring Frequency Every five years

References Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

Indicator **Management restrictions on visitor behavior**

MEASURE 2-10 TRAIL MILES / ACRES WITH RESTRICTED USE

Definition	The number of trail miles and acres within the HPBH WSA where specific types of recreational use are restricted.
Context	<p>The Gallatin National Forest has published nine revisions to the Travel Plan of 1977. Travel plans established restrictions on travel management and use in the HPBH WSA. Several significant closures and restrictions have been put in place in the last two decades in order to maintain wilderness character and provide resource protection.</p> <p>The rationale for current trail use restrictions, as outlined in the 2006 Gallatin National Forest Travel Management Plan, was to establish a travel management scenario consistent with the direction of the Montana Wilderness Study Act (FEIS, page 3-597). In response to court proceedings from resulting appeals to the 2006 plan, an interim travel management plan was in place in 2011 (see Recent Trends, below; Heath 2006).</p>
Relevance	As they exist today, restrictions on HPBH trail and area uses serve mainly to protect wilderness character, maximize opportunities for solitude, and protect trail facilities. If future restrictions are placed on trail or areas for use by foot or stock these restrictions may degrade opportunities for primitive recreation.
Data Source	Data were compiled from the Gallatin National Forest GIS Library and Gallatin National Forest Interim HPBH WSA Summer and Winter Travel Management Orders (11-11-00-02, 11-11-00-03; Appendices C and D).
Data Adequacy	GIS records provide an accurate accounting of trail miles and WSA acres affected by restrictions.
Recent Trend(s)	Development of the 2006 Gallatin National Forest Travel Management Plan and the court proceedings from resulting appeals has caused review and revision of trail use restrictions in the HPBH WSA. The Interim Strategy in place in 2010-2011 reduced the trail mileage open to motorcycle, mountain bike, and snowmobile use. The Strategy also established 15 miles of timeshare trail where different uses are authorized on alternating days. The Interim Strategy also prohibits ATV use on all HPBH WSA trails, as did the 2006 Travel Plan Decision. All trails are available for hiking at all times. Stock and mountain bike use are seasonally restricted on several trails (Buffalo Horn, Porcupine, Teepee, and South Rock Creeks) during spring to protect trail facilities.
2011 Baseline	<p>The 2010 Gallatin National Forest Interim Summer and Winter Travel Orders (Appendices C and D) defined recreation use restrictions in the HPBH WSA in 2011. A total of 148 trail miles within the WSA were accessible by foot and stock use only. Sixty miles of trail were open to some combination of foot, stock, motorcycle, and mountain bike use (including timeshare trails; see Table 14 and Figure 19).</p> <p>There are also winter restrictions on snowmobile use within the HPBH WSA. Snowmobile use is restricted on all trails except for the 12 mile long Big Sky Snowmobile Trail (#900), which is open between December 2nd and April 15th. Approximately 2666 acres of the HPBH WSA is open to off-trail snowmobile use, including a ¼ mile buffer zone along the Big Sky Trail and a small “play area”</p>

in the Golden Trout Lakes vicinity. Off-trail snowmobile use is not allowed on the WSA's remaining 152,335 acres (Figure 20).

Table 14. Summary of trail use restrictions, 2011

Trail Use Restriction	Trail Miles*	Acres
No ATV use	208	N/A
No snowmobile use	196	N/A
No motorcycle or mountain bike use	148	N/A
No motorcycle use	21	N/A
Timeshare restrictions	15	N/A
Miles of trail with seasonal restrictions for stock or mountain bikes	11	N/A
Area closed to snowmobiling	N/A	152,335

* There are a total of 208 system trail miles in the HPBH WSA.

Figure 19. Interim summer trails

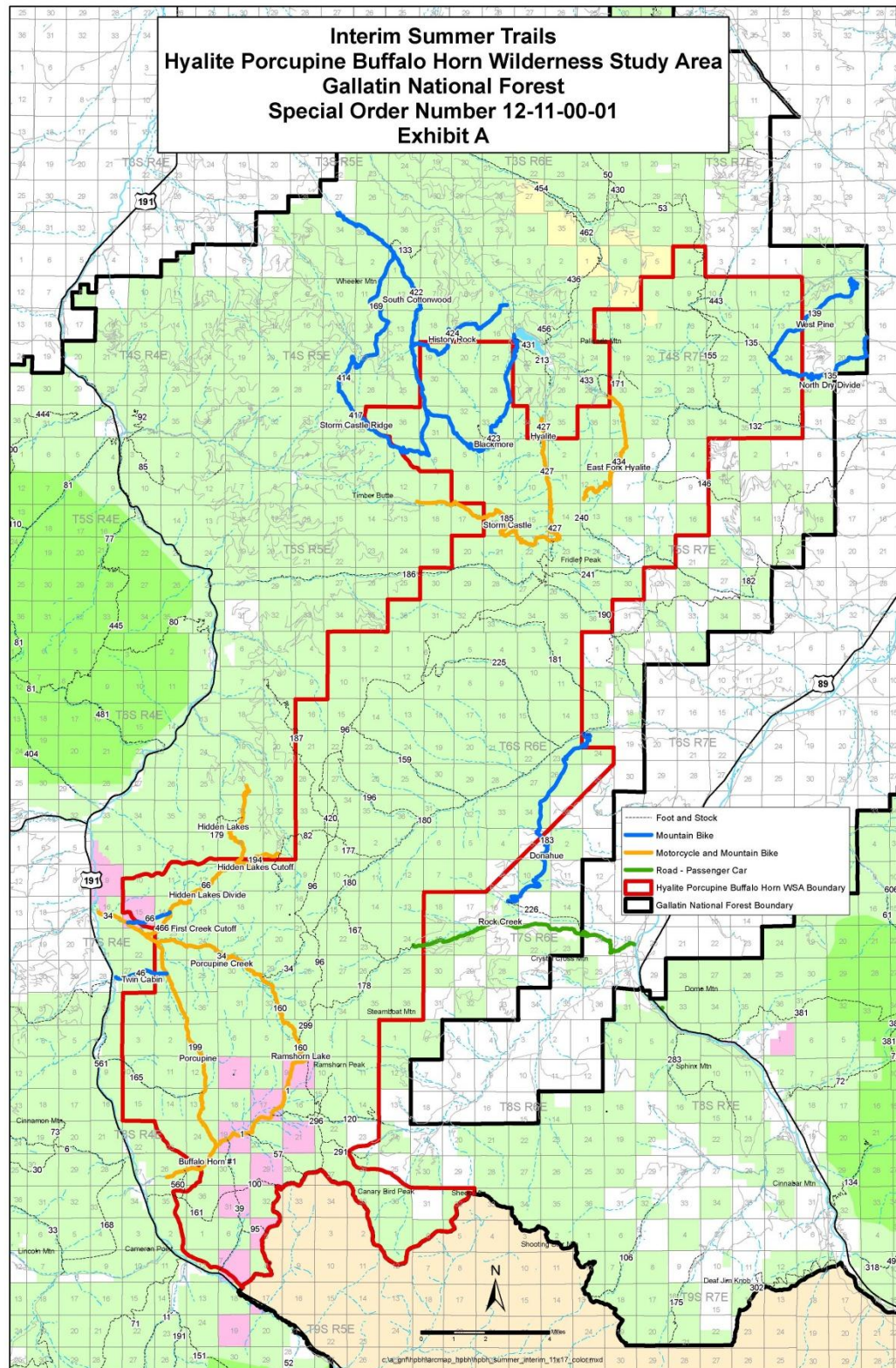
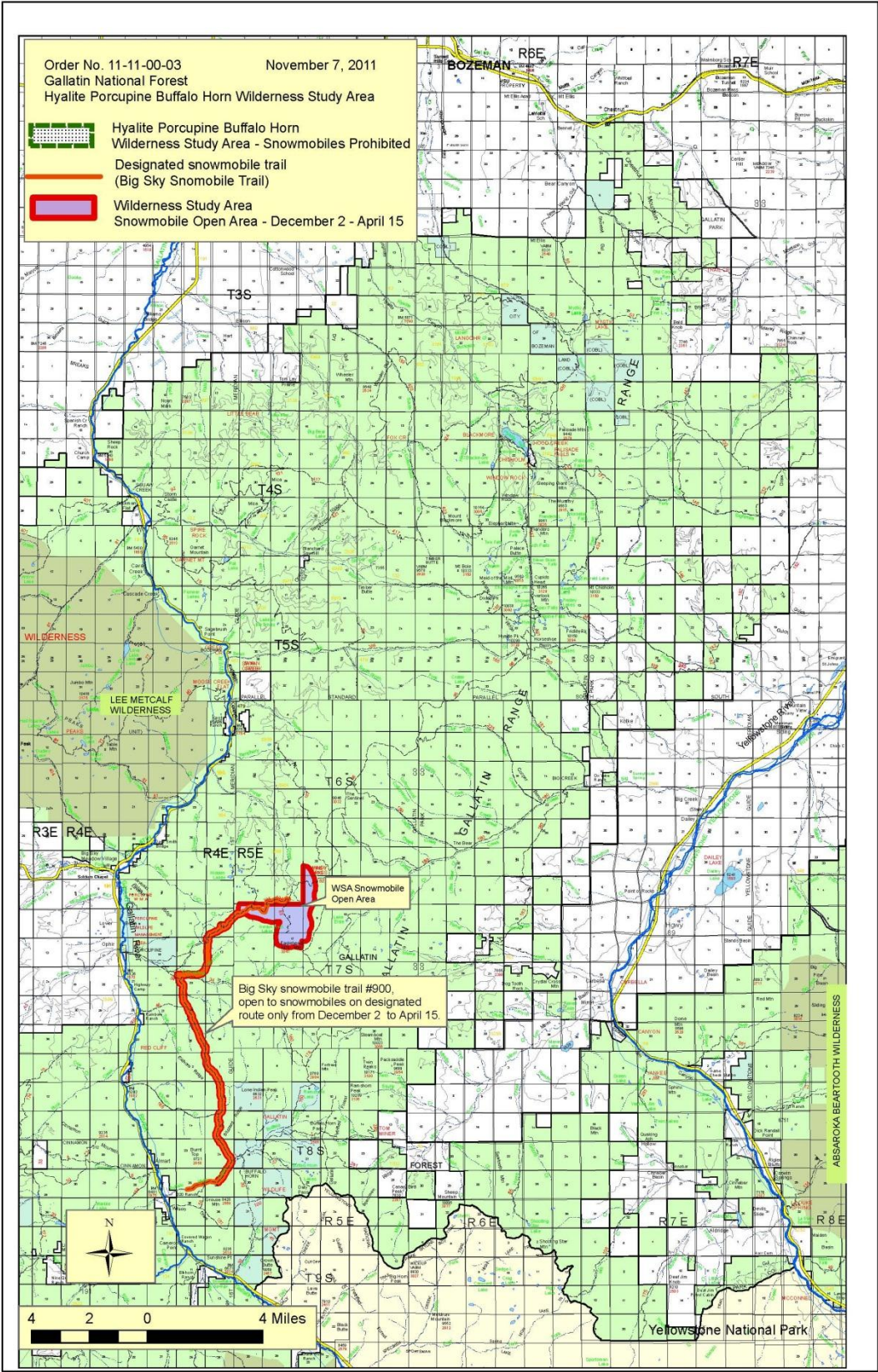


Figure 20. Snowmobile trail and open area



Significant Change Travel management decisions within the WSA have been in significant flux since designation in 1977. Over the last 34 years, iterations of travel decisions have changed recreation opportunities in the WSA several times. Most recently, additional restrictions were placed on WSA trails following litigation of the 2006 Travel Plan. These are the most restrictive since the area was designated in 1977. Table 1 (see Introduction) shows trend over time of recreation opportunities.

Monitoring Frequency Every five years

References Gallatin National Forest Interim HPBH WSA Summer and Winter Travel Management Orders (11-11-00-02, 11-11-00-03)

Heath, Rebecca. 2006. Gallatin National Forest Travel Management Plan Record of Decision.

Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

MEASURE 2-11 NUMBER OF ADDITIONAL MANAGEMENT RESTRICTIONS

Definition	The number of additional management restrictions on recreational use in the HPBH WSA other than the number of trail miles / acres with travel restricted use (see Measure 2-10).
Context	Management restrictions that affect the HPBH WSA are often Greater Yellowstone Ecosystem or Gallatin National Forest-wide restrictions and are not specific to the HPBH WSA. For example, length of stay restrictions enacted in 2009 are general restrictions for the entire Greater Yellowstone Area. Stock use restrictions present in 2011 were applicable for all non-wilderness areas in the Greater Yellowstone Area. In 2011, the only HPBH WSA-specific restrictions were travel related.
Relevance	Management restrictions on recreational activities and use may limit user's opportunities for primitive recreation.
Data Source	Data were obtained from Special Order No. GYCC-6 "Greater Yellowstone Area National Forests General Restrictions" and various Gallatin National Forest special order restrictions.
Data Adequacy	This assessment includes all known special restrictions within the WSA at this time.
Recent trend(s)	In April 2009, a Special Order (Order No. GYCC-6) established a set of general restrictions for the Greater Yellowstone Area, including the Gallatin National Forest. This Special Order remains in effect and the 2011 Baseline for this measure reflects these restrictions. No additional regulations have been imposed on visitor use of the HPBH WSA (other than travel restrictions) in the last five years and few have been imposed since WSA establishment.
2011 Baseline	The 2011 index total is 3 (see Table 15).

Table 15. Summary of active additional management restrictions, 2011

Category	2011 Score*	Weight*	Total
Campfires	0	--	0
Camping	0	--	0
Fees	0	--	0
Permits	0	--	0
Human waste	0	--	0
Length of stay	1	1	1
Stock use	1	2	2
Swimming/bathing	0	--	0
Area closure	0	--	0
Group size limits	0	--	0
Leash requirements	0	--	0
Index Total			3

* Definitions for category weights and scores are found in Landres et al. 2009.

Significant Change TBD

Monitoring Frequency Every five years

References Landres, P.; Boutcher, S.; Dean, L.; Hall, T.; Blett, T.; Carlson, T.; Mebane, A.; Hardy, C.; Rinehart, S.; Merigliano, L.; Cole, D. N.; Leach, A.; Bumpus, D. 2009. Technical guide for monitoring selected conditions related to wilderness character. Gen. Tech. Rep. RMRS-GTR-WO-80. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. (See pages 215-220.)

UNDEVELOPED QUALITY

The Wilderness Act states that wilderness is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation,” where, “man himself is a visitor who does not remain,” with “the imprint of man’s work substantially unnoticeable.” This quality is degraded by the presence of structures, installations, habitations, and by the use of motor vehicles, motorized equipment, or mechanical transport that increases people’s ability to occupy or modify the environment. Note: following Landres et al. 2009, non-recreational developments are included within this quality and recreational developments are included in the “opportunities for primitive recreation” quality of wilderness character (see Measure 2-6 and Measure 2-7).

Monitoring Question: What are the trends in non-recreational development inside this WSA?

Indicator Non-recreational installations, structures, and developments

MEASURE 3-1 NUMBER OF AUTHORIZED NON-RECREATIONAL PHYSICAL INSTALLATIONS AND DEVELOPMENTS

Definition	The total number of known, authorized non-recreational physical installations and developments within the HPBH WSA.
Context	<p>A number of authorized physical installations and developments exist across the HPBH WSA, including range developments, structures remaining on portions of the HPBH WSA which were once private land, and miscellaneous management structures unrelated to recreation (e.g. dams, lookouts, etc.).</p> <p>This measure does not include authorized recreational developments, which are summarized in Measure 2-6.</p>
Relevance	As the number of authorized physical developments within the HPBH WSA increases the undeveloped quality of wilderness character is degraded.
Data Source	In 2011, the University of Montana Wilderness Institute field crews traversed all trail miles within the HPBH WSA and recorded all types of human installations and developments encountered, including corrals, dams, repeaters, fences, old mines, old cabins, lookouts, pole stashes, cairns, hitch rails, and electronic equipment (Noson and Filardi 2011). Forest staff and databases were consulted to assign inventoried installations and developments into appropriate categories (e.g. recreational vs. non-recreational and authorized vs. unauthorized).
Data Adequacy	Wilderness Institute crews did not survey off-trail areas in the HPBH WSA, so developments located away from system and non-system trails may have been overlooked. Off-trail installations, such as telephone and water-measuring equipment, were cross-referenced with Schlenker (2003) and existing forest records and then added to the inventory when appropriate.
Recent Trend(s)	The number of installed electronic sites has remained the same since 1977. In the last decade, there have been no removals of authorized non-recreational physical installations or developments.
2011 Baseline	There were 55 authorized physical developments in the HPBH WSA (Table 16).

Table 16. Authorized non-recreational installations and developments

Type	Number
Signs	28
Fences	9
Cabins	3
Communication towers	7
Water storage developments	4
Other	4*

* 2 telephone equipment installations, 1 installation of water measuring equipment, and 1 enclosure

Fourteen of the installations and developments in Table 16 are historic remains and, therefore, the original purpose/authorization is not entirely clear or relevant (e.g. sections of old fence, unreadable signs, and old telegraph mounts).

Significant Change TBD

Monitoring Frequency Every five years

References Gallatin National Forest Special Use Permit Records

Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

MEASURE 3-2 NUMBER OF UNAUTHORIZED NON-RECREATIONAL PHYSICAL INSTALLATIONS AND DEVELOPMENTS

Definition	The total number of known, unauthorized non-recreational physical installations and developments within the HPBH WSA.
Context	Unauthorized installations and developments can take many forms, but within the HPBH WSA they are most commonly signs.
Relevance	As the number of unauthorized physical developments within the HPBH WSA increases the undeveloped quality of the WSA is degraded.
Data Source	In 2011, the University of Montana Wilderness Institute field crews traversed all trail miles within the HPBH WSA and recorded all types of human installations and developments encountered, including corrals, dams, repeaters, fences, old mines, old cabins, lookouts, pole stashes, cairns, hitch rails, and electronic equipment (Noson and Filardi 2011). Forest staff and databases were consulted to assign inventoried installations and developments into appropriate categories (e.g. recreational vs. non-recreational and authorized vs. unauthorized).
Data Adequacy	Wilderness Institute crews did not survey off-trail areas in the HPBH WSA, so unauthorized non-recreational developments located away from system and non-system trails may have been overlooked.

Recent Trend(s) Prior to 2011, no inventory of unauthorized physical installations and developments existed; recent trends are unknown.

2011 Baseline There were 6 unauthorized physical developments in the HPBH WSA, all of which are signs. They include memorials, dedications, and no trespassing signs.

Significant Change TBD

Monitoring Frequency Every five years

References Noson, A.; Filardi, C. 2011. Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT.

Indicator Inholdings

MEASURE 3-3 ACRES OF INHOLDINGS

Definition The total acres of land held by private, city, and state entities within the HPBH WSA. An inholding is considered within the HPBH WSA if it is surrounded on two or more sides by the WSA.

Context Schlenker (2003) notes that since the time of WSA designation in 1977, “the most significant change affecting the HPBH study area...is the acquisition of over 37,000 acres of checkerboard private land within it”. Most of the land acquired in the 1990’s (35,667 acres in 1993; 1,283 acres in 1999) was previously owned by Burlington Northern Railroad and subsequently by their timber subsidiary, Plum Creek Timber, Inc.

The acquisition of inholdings in the 1990’s improved public access to the HPBH WSA in several places with previously questionable access.

Relevance Inholdings complicate management of the HPBH WSA in a number of ways. For example, inholdings are not managed to maintain wilderness character, and private landholders can block public access to the WSA, utilize motorized vehicles and equipment, alter natural processes (such as through timber harvesting), and develop roads and structures. In addition, the Forest Service is required to provide access through the WSA for inholding owners, which may include motorized access allowances. As a result, the presence and management of inholdings degrades the opportunities for solitude quality of wilderness character.

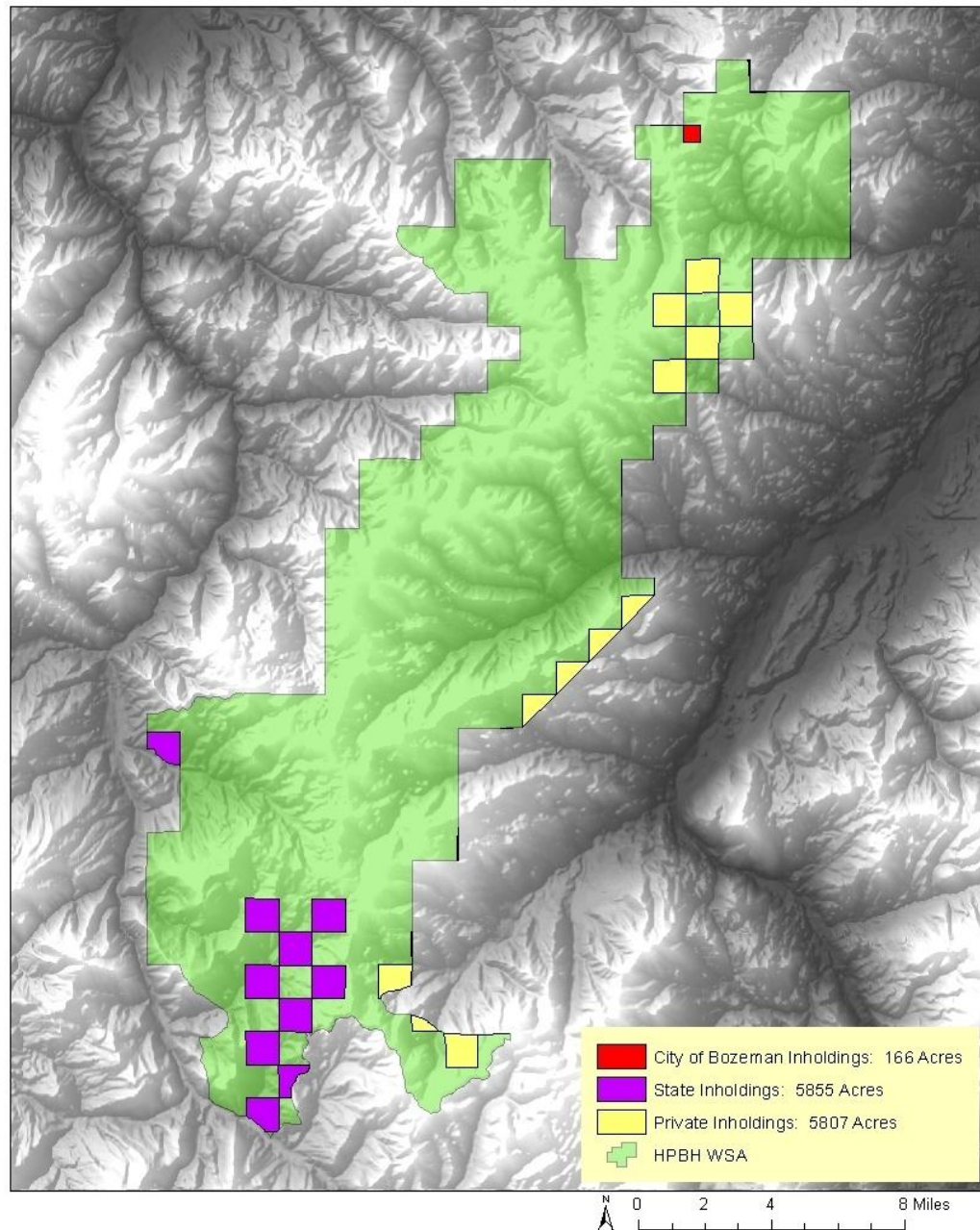
Data Source Data were obtained from the Gallatin National Forest GIS library.

Data Adequacy The use of GIS data has greatly increased the accuracy of inholding acreage calculations.

Recent trend(s) Large inholding acquisitions were made in the 1990’s. Since 2000, no additional private inholding acreage has been acquired.

2011 Baseline As of 2011, there were 11,828 acres of inholdings within the HPBH WSA (5,807 acres of private land, 166 acres held by the City of Bozeman, and 5,855 held by the state of Montana).

Figure 21. Inholdings, 2011



Significant Change TBD

Monitoring Frequency TBD

References Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

USDA. 1997. Montana Wilderness Study Act Litigation CV-96-152-M-DWM Administrative Record.

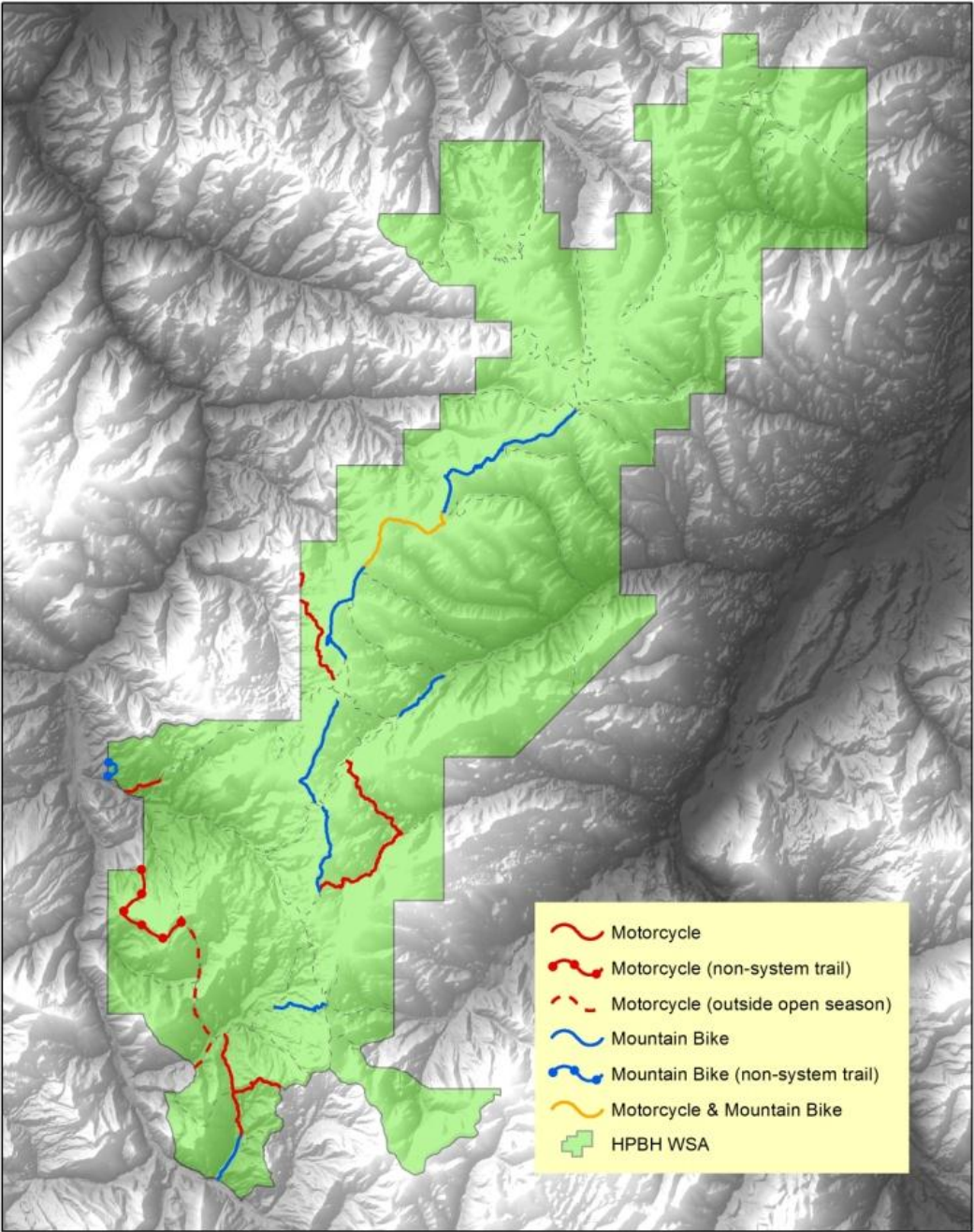
Monitoring Question: What are the trends in mechanization inside this WSA?

Indicator **Use of motorized vehicles, motorized equipment, and mechanical transport**

MEASURE 3-4 NUMBER OF TRAIL SEGMENTS WITH EVIDENCE OF UNAUTHORIZED MOTORIZED OR MECHANIZED VEHICLE USE

Definition	The number of trail segments with evidence of unauthorized motorized or mechanized vehicle use, per current travel restrictions, based on a single survey of all trails in the WSA.
Context	<p>Current Forest Service policy does not restrict the use of motorized equipment in wilderness study areas, but does restrict the use of motorized and mechanized vehicles. This measure, therefore, does not address use of mechanized equipment.</p> <p>The 2012 interim summer travel restrictions (Special Order Number 12-11-00-01; see Figure 19, above) define trail segments on which motorized or mechanized vehicle use is unauthorized and specifies timeshares for specific trail segments. The compilation of data for this measure relied on the restriction information contained in this Special Order and dealt only with trail segments within the WSA boundary.</p> <p>Evidence of unauthorized vehicle use included tracks observed on closed trails and evidence recorded prior to open season on designated trails. This measure is not designed to capture volume of vehicle use, but indicates presence of evidence (e.g. tracks) from a single survey of system and non-system trails in the HPBH WSA. This measure does not include use after seasonal closure dates. Whether vehicles (authorized or unauthorized) leave evidence is subject to trail and weather conditions. Therefore, this measure tallies the minimum number of trail segments with evidence of violation, since violations may have occurred without leaving evidence on one or many trail segments traversed. In at least one case, access via adjacent trails likely occurred but evidence was not present.</p>
Relevance	Unauthorized motorized and mechanized vehicle use degrades the undeveloped quality of wilderness character.
Data Source	University of Montana Wilderness Institute field crews conducted a single pass survey of system and non-system trails during the summer of 2011 (Noson and Filardi 2011).
Data Adequacy	This measure represents data from a single survey of all system trails in the HPBH and is a conservative assessment of violations. For example, dry, hard packed trail may not provide evidence of recent motorized or mechanized vehicle use, weather may eliminate evidence of vehicle use, and a single survey of all trail segments does not account for use across the duration of a season.
Recent Trend(s)	Data for this measure was first collected in 2011. There is no available recent trend information.
2011 Baseline	In 2011, there were 11 trail segments, totaling 36.5 miles, with evidence of unauthorized motorcycle use, including two trail segments with evidence of use prior to open season (July 16 – September 4). There were 13 trail segments, totaling 28.3 miles, with evidence of unauthorized mountain bike use.

Figure 22. Trail segments with evidence of unauthorized vehicle use, 2011



Significant Change TBD

Monitoring Frequency Every five years

References 2011 interim summer travel restrictions (Special Order Number 11-11-00-02; Appendix C)

UNTRAMMELED QUALITY

The Wilderness Act states that wilderness is an area “where the earth and its community of life are untrammelled by man,” and that has “been affected primarily by the forces of nature.” In short, wilderness is essentially unhindered and free from modern human control or manipulation. This quality is degraded by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness.

Monitoring Question: What are the trends in actions that control or manipulate the “earth and its community of life” inside this WSA?

Indicator **Authorized actions that manipulate the biophysical environment**

MEASURE 4-1 ACRES WITH NOXIOUS WEED MITIGATION ACTIONS

Definition	Five-year average of the acres per year where actions were taken to mitigate noxious weeds.
Context	<p>The Forest Service noxious weeds are designated by the Secretary of Agriculture or the responsible State official and generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, or a carrier or host of serious insects or disease (FSM 2080.5).</p> <p>This measure compiles data about all actions taken to mitigate weeds. These actions can include, but are not limited to, chemical treatment, hand pulling, and use of bio-controls.</p>
Relevance	Efforts to mitigate weeds are generally taken to preserve and improve the natural quality of an area. Actions taken to mitigate weeds, however, constitute a form of trammeling by deliberately disturbing soil processes, disrupting soil communities, altering the plant community, and otherwise impacting natural processes. As annual weed mitigation efforts increase, the untrammelled nature of the HPBH WSA is degraded, despite the possible positive impact these same actions have on the WSA's natural quality.
Data Source	As of 2011, Natural Resource Manager (NRM) is the source for spatial weed data and Forest Service Activity Tracking System (FACTS) is the source for tabular data including species and treatment type. This data separation precluded efforts to fully account for all weed mitigation actions. Once combined (in process), more reliable, accessible, and complete data will be available.
Data Adequacy	Current data is incomplete, especially for the HPBH's east side. Data will improve once the Forest Service Natural Resource Management FACTS database is updated.
Recent Trend(s)	In 2010, 10 acres on the west side of the HPBH WSA were managed for weeds; species and treatment methods are unavailable. Data for the east side of the HPBH WSA is not available for 2010.
2011 Baseline	<p>In 2011, Wilderness Institute field crews pulled weeds from 64 patches totaling 0.125 acres. In addition, crews partially pulled weeds from 15 patches for which acreage values are not available.</p> <p>Since data is not available for 2006 through 2009, a five-year average cannot be provided. For 2010 and 2011 acres of weed mitigation actions averaged 5.06 acres/year.</p>

Significant Change TBD

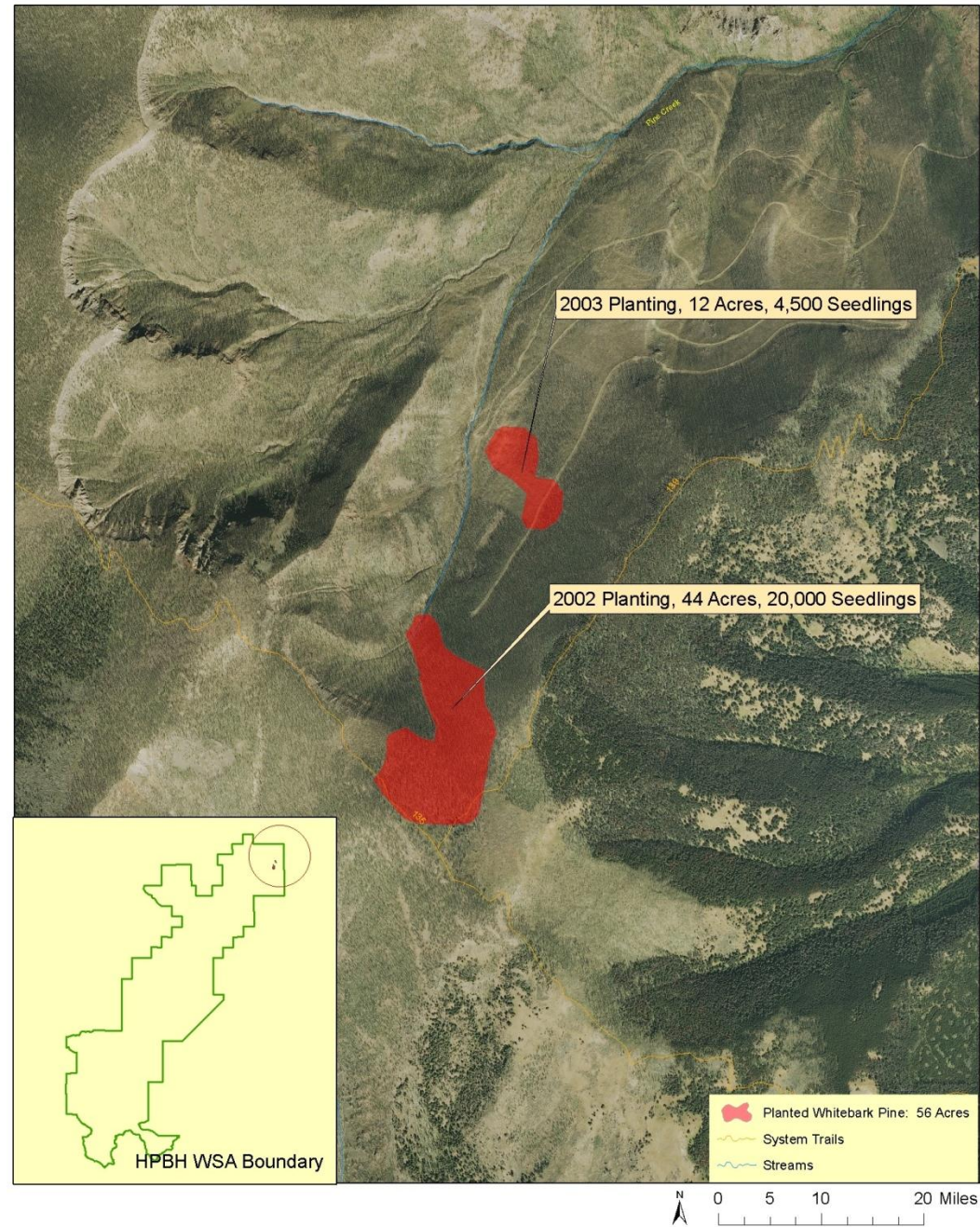
Monitoring Frequency Every five years

References USDA. 1995. USDA Forest Service Manual on Noxious Weed Management. FSM 2080.5.

MEASURE 4-2 ACRES OF VEGETATION PLANTED

Definition	Acres within the HPBH WSA where vegetation was planted for restoration, remediation, or other ecological purposes.
Context	Historically, vegetation planting has been rare within the HPBH WSA.
Relevance	The planting of vegetation acts as a substitute for natural regeneration processes or is designed to alter the natural species composition of an area. The act of planting is, regardless of the specific aim of the planting, an alteration of natural processes—and therefore affects the untrammelled quality of wilderness character.
Data Source	Data were compiled from Gallatin National Forest's Forest Ecology Group records and GIS data.
Data Adequacy	Accurate records, including detailed GIS data, are kept for all HPBH WSA plantings.
Recent trend(s)	<p>Twice in the last decade vegetation has been planted within the HPBH WSA. Both plantings were of whitebark pine seedlings in areas burned by the Fridley fire of 2001. In 2002, 44 acres were planted with 20,000 whitebark pine seedlings and in 2003, 12 acres were planted with 4,500 whitebark pine seedlings. In both cases plantings were intended to maintain the pre-fire stand composition.</p> <p>No additional plantings have occurred in the HPBH WSA since 2003.</p>

Figure 23. Whitebark pine plantings, 2002 & 2003



2011 Baseline Zero acres within the HPBH WSA were planted in 2011.

Significant Change TBD

Monitoring Frequency Every five years

References Forest Ecology Group, Gallatin National Forest
Timber Stand Management database (TSMRS; historic data only)

MEASURE 4-3 PERCENT OF NATURALLY IGNITED WILDFIRES THAT RECEIVE A SUPPRESSION RESPONSE

Definition	Percentage of naturally ignited wildland fires within the HPBH WSA each year that are suppressed, or that receive some degree of fire suppression response.
Context	<p>Prior to September 2011, 100% of unplanned and human-caused ignitions received a suppression response in varying degrees. The initial HPBH WSA Study Report (USDA 1985) emphasized fire suppression to maintain timber management areas, old growth, limit soil damage, etc. The 1987 Forest Plan (USDA 1987) places much of the HPBH within management areas subject to a “wildfire suppression response of... control, contain or confine.” Other Forest Plan management areas that fell within the HPBH WSA boundary also emphasized fire suppression. All lands acquired since 1987 have no management area direction, much less fire management standards.</p> <p>The 2011 Fire Management Amendment to the Forest Plan changes the fire management direction across the Forest, and allows for all fire management strategies (including use of fire) to be considered on all National Forest land, including the HPBH WSA. 2012, therefore, will become the baseline to measure/monitor unplanned wildland fire strategies used within the HPBH WSA.</p> <p>This measure does not take into account suppression of human-ignited fires. Although humans have been present on this landscape for centuries, modern, human-ignited fires are not considered part of the established natural processes. All human-caused, unplanned ignitions (regardless of their location) are suppressed in accordance with National and State of Montana fire policies.</p> <p>Measure 3-6 captures trends related to the prevalence of human-ignited fires within the WSA.</p>
Relevance	<p>Suppression of naturally ignited wildfires disrupts the natural roles and processes that fire plays in ecosystems. These roles and processes include, but are not limited to, releasing seeds from serotinous species’ cones, creating bare mineral soil for vegetation that requires such conditions to regenerate, maintaining meadow systems, etc. As the percent of suppression of naturally ignited wildfires increases the untrammelled quality of wilderness character may be degraded.</p> <p>The use of fire suppression techniques can also result in significant physical changes to the area. For example, suppression of the 2001 Fridley Fire required the construction of spike camps, fire lines, and staging areas. All impacted areas were later rehabilitated, including several heavily impacted trails.</p> <p>Fire suppression efforts also can include the use of motorized vehicles and motorized or mechanized equipment. In the Fridley Fire, helicopters, pumps, and chainsaws were utilized within the HPBH WSA. Wildfire suppression responses can, therefore, also degrade the natural, undeveloped, and opportunities for solitude qualities of wilderness character.</p>
Data Source	Data were compiled from fire records for the Gallatin National Forest (maintained in the FIRESTAT and FamWeb databases; 1940-present; see Shea 2012).
Data Adequacy	Accurate and detailed fire records are maintained, yet it is possible that some small, natural ignitions within the HPBH WSA go undetected and, therefore, are not recorded or suppressed.
Recent trend(s)	Since 1987 all naturally-ignited wildland fires in the HPBH WSA were suppressed. In the last decade (2000-2010), 18 naturally-ignited wildland fires occurred or burned into the HPBH WSA, and received some degree of suppression action.

2011 Baseline In 2011, there were no naturally ignited wildfires in the HPBH WSA.

Significant Change TBD

Monitoring Frequency Every five years

References 2011 Fire Management Amendment decision to the 1987 Forest Plan

Gallatin National Forest Fire Records stored in the FIRESTAT and FamWeb databases

Shea, Julie. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library).

USDA. 1985. Hyalite Porcupine Buffalo Horn Wilderness Study Report.

USDA. 1987. Gallatin National Forest Forest Plan.

MEASURE 4-4 ACRES OF PRESCRIBED FIRE

Definition The average annual acres treated with management-ignited prescribed fire over a five-year period. This measure also details the average annual acres that received mechanical pre-treatment prior to management-ignited prescribed fire over the same five-year period.

Context Prescribed fire may be used to meet management area goals for all management areas within the WSA boundary (USDA 1987, p. 111-112), as long as the proposal maintains or improves wilderness character.

Relevance Prescribed fire may not have the same effects on the landscape as natural fire due to time of year when executed, severity, intensity, and other factors. Prescribed fire is a management action and therefore an act of trammeling. An increasing number of acres burned by prescribed fire degrades the untrammelled quality of wilderness character.

Data Source Data were compiled from the FACTS database and legacy Timber Stand Management Record System (TSMRS databases; see Shea 2012).

Data Adequacy Detailed, accurate spatial records of prescribed fires have been maintained since 1990.

Recent Trend(s) There have been, and continue to be, management proposals to use prescribed burning to reduce hazardous fuel conditions within the WSA where wilderness urban interface (WUI) areas are adjacent to the WSA boundary. Proposals for prescribed fire within the WSA are announced in the Forest's quarterly Schedule of Proposed Actions (SOPA).

Since 1977, approximately 572 acres within the WSA have had some fuel management action or prescribed fire treatment (TSMRS databases). Prior to 1977, hand piles, created following timber harvest activities, were burned in several areas.

2011 Baseline Recently, there have been several planning efforts proposing management-ignited fire within the WSA with goals of managing fuel conditions and reducing conifer encroachment into grass and shrub lands. None of these planning efforts have come to fruition. As such, there have been no

mechanical treatments or prescribed burning actions related to fuel management within the WSA boundary since 1992.

Significant Change TBD

Monitoring Frequency Every five years

References Forest Service Activity Tracking System (FACTS) Database

Schlenker, Kimberly. 2003. Hyalite Porcupine Buffalo Horn Wilderness Study Area Character Assessment. Gallatin National Forest.

Shea, Julie. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library).

Timber Stand Management Recording System (TSMRS) Legacy Data

USDA. 1987. Gallatin National Forest Forest Plan.

MEASURE 4-5 NUMBER OF LAKES AND OTHER WATERBODIES STOCKED WITH FISH

Definition The number of lakes and other waterbodies actively stocked with fish within the HPBH WSA. Waterbodies are defined as lakes, ponds, rivers, and streams/creeks.

Context Management of fish populations falls under the jurisdiction of Montana Department of Fish, Wildlife, and Parks. Fishing, particularly for trout and Arctic grayling, is a popular recreational use of the HPBH WSA (USDA 1997).

Lakes

There are 22 named lakes and other waterbodies within the HPBH WSA (seven in the Yellowstone River drainage and 15 in the Gallatin River drainage; Table 17). Records of fish stocking in a select portion of these lakes and waterbodies date back to 1943, although it is possible that stocking occurred prior to 1943. Prior to stocking, all lakes within the HPBH were presumably fishless.

Twelve of the 22 lakes and waterbodies have never been stocked. The ten stocked lakes contain one of five non-native Salmonidae species: Yellowstone cutthroat trout, unspecified cutthroat trout, rainbow trout (*O. mykiss*) golden trout (*O. aquabonita*), or Arctic grayling (*Thymallus arcticus*). It is assumed that unspecified cutthroat trout in the HPBH are actually Yellowstone cutthroat trout. The two lakes stocked with rainbow trout (*Oncorhynchus mykiss*) are now fishless, so this species is no longer present in any HPBH WSA lake or other waterbody.

Only two of the 10 stocked lakes are still actively stocked (Heather Lake and Lake Elsie, Table 17). Of the eight no longer actively stocked, four are currently fishless (Blackmore Lake, Hyalite Lake, Upper Fridley Lake, and Bear Lake) and four are self-sustaining through natural reproduction (Arctic grayling in Emerald Lake, golden trout in two Golden Trout Lakes, and Yellowstone cutthroat trout in Ramshorn Lake; Table 17).

Emerald Lake contains both Arctic grayling and Yellowstone cutthroat trout. The Yellowstone cutthroat trout are likely a result of the MFWP stocking program in Heather Lake. It is unknown if the Emerald Lake Yellowstone cutthroat trout are naturally reproducing.

Two of the three Golden Trout Lakes contain naturally reproducing golden trout.

Other waterbodies

Elkhorn Creek is the only other waterbody with historical or current stocking activity.

Historically, Elkhorn Creek was a tributary of the Gallatin River. Today Elkhorn Creek is naturally cut-off by several ancient landslides which divert all water into a natural underground cavern. It is unknown where Elkhorn Creek water enters the Gallatin River. Above the natural diversion, Elkhorn Creek is fishless.

In 2007 or 2008, Gallatin National Forest and MFWP fisheries biologists identified Elkhorn Creek as a potential site for introduction of westslope cutthroat trout. In 2009 and 2010, eggs from genetically pure populations within the Gallatin River drainage were introduced to the creek. Although survival rates appear to be low and eggs were not placed in 2011, MFWP plans to continue stocking until the total parentage of the introduced population is greater than 50 (to ensure genetic diversity).

Table 17. History of fish stocking, 1943-present

Name	Drainage	Species Stocked					Current Status
		Yellowstone Cutthroat Trout	Undescribed Cutthroat Trout	Rainbow Trout	Golden Trout	Arctic Grayling	
Crater Lake	Gallatin	-	-	-	-	-	Naturally fishless
Flanders Lake	Gallatin	-	-	-	-	-	Naturally fishless
Blackmore Lake	Gallatin	-	-	X (1946)	-	-	Currently fishless
Arden Lake	Gallatin	-	-	-	-	-	Naturally fishless
Palace Lake	Gallatin	-	-	-	-	-	Naturally fishless
Emerald Lake	Gallatin	-	X (1946)	-	-	X (Unknown)	Self-sustaining
Swim Lake	Gallatin	-	-	-	-	-	Naturally fishless
Swim Lake	Gallatin	-	-	-	-	-	Naturally fishless
Heather Lake	Gallatin	X (1984-2009)	X (1946-1963)	-	-	-	Currently stocked every 4 years
Hyalite Lake	Gallatin	X (1967-1986)	X (1946-1960)	-	-	-	Currently fishless
Golden Trout Lakes	Gallatin	-	-	-	X (Unknown)	-	Self-sustaining
Golden Trout Lakes	Gallatin	-	-	-	X (Unknown)	-	Self-sustaining
Golden Trout Lakes	Gallatin	-	-	-	-	-	Naturally fishless
Ramshorn Lake	Gallatin	-	X (1950-1960)	-	-	-	Self-sustaining
Buffalo Horn Lakes	Gallatin	-	-	-	-	-	Naturally fishless
Bear Lake	Yellowstone	-	X (1951)	X (1950)	-	-	Currently fishless

Table 17 continued on following page

Table 17. (continued from previous page)

Twin Lakes	Yellowstone	-	-	-	-	-	Naturally fishless
Fridley Lake, Upper	Yellowstone	X (1967-1979)	-	-	-	-	Currently fishless
Fridley Lake, Lower	Yellowstone	-	-	-	-	-	Currently fishless
Mud Lake	Yellowstone	-	-	-	-	-	Naturally fishless
Lake Elsie	Yellowstone	X (1943-2009)	-	-	-	-	Currently stocked every 4 years
Twin Lakes	Yellowstone	-	-	-	-	-	Naturally fishless

Relevance The stocking of fish has resulted in the introduction and successful establishment (i.e. naturally self-sustaining reproductive populations) of non-native species in four HPBH WSA waterbodies (Table 17). Even when native species are stocked, these introductions modify population genetics and alters natural reproductive processes and population fluctuations. An increase in the number of stocked waterbodies degrades the untrammeled quality of wilderness character.

Data Source Data were obtained from the Montana Fish, Wildlife, and Park's MFISH Database (see Roberts 2012).

Data Adequacy Detailed, accurate records are kept of all fish stocking activities within the Gallatin National Forest, including the HPBH WSA.

Recent trend(s) Since 1986, only two HPBH WSA lakes have been actively stocked: Heather Lake and Lake Elsie. In 2009, stocking of westslope cutthroat trout began in Elkhorn Creek.

2011 Baseline Three HPBH WSA waterbodies have been stocked within the last five years: Heather Lake, Lake Elsie, and Elkhorn Creek. Heather Lake and Lake Elsie are currently stocked with Yellowstone cutthroat trout every four years. The lakes were last stocked in 2009. Active stocking of genetically pure westslope cutthroat trout fry occurred in Elkhorn Creek in both 2009 and 2010.

Significant Change TBD

Monitoring Frequency Every five years

References Roberts, Bruce. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library).

USDA. 1997. Montana Wilderness Study Act Litigation CV-96-152-M-DWM Administrative Record.

Indicator *Unauthorized actions that manipulate the biophysical environment*

MEASURE 4-6 NUMBER OF HUMAN-CAUSED FIRE STARTS

Definition The number of detected human-caused fire starts within the HPBH WSA.

Context 73 wildland fires have been detected in the HPBH WSA since the 1940s. Of these fires, human-caused fires account for 23 (32%) of these starts and include fires resulting from burning vehicles, exhaust (from powersaws or other sources), and warming fires. Powersaw exhaust is the most common source of human-caused ignitions (65% of all human-caused ignitions since 1940).

Relevance	Human-caused wildland fires may result in fires in areas not historically prone to fire or may result in fire frequencies greater than the historical fire return interval. An increase in the number of human-caused fire starts degrades the untrammeled quality of wilderness character.
Data Source	Data were compiled from the FIRESTAT and FireFamilyPlus database records (1940-2011; see Shea 2012).
Data Adequacy	This data accurately reflects all detected fire starts, but cannot account for undetected starts. Human-caused fire starts may result in very small fires that go undetected.
Recent trend(s)	Between 2001 and 2005, there were five human-caused fire starts at a frequency of one per year. Two fire starts were the result of warming fires and three resulted from powersaw exhaust. The largest fire was 1.5 acres with the remaining four all less than 0.1 acre. Since 2005, there have been zero human-caused fire starts.
2011 Baseline	There were zero human-caused fire starts in 2011.
Significant Change	TBD
Monitoring Frequency	TBD
References	Shea, Julie. 2012. Gallatin National Forest Specialist Report (archived in the Gallatin National Forest data library).

CONSIDERED, UNIMPLEMENTED MEASURES

MEASURE A. DISTRIBUTION OF PIKA

Quality / Indicator: Natural / Plant & Animal Species and Communities

Reason not used: Data collected is part of a citizen observation survey, and is not part of a standardized monitoring protocol. If a spatially and temporally comprehensive survey protocol is implemented, this measure will be reconsidered.

Possible data source(s): April Craighead, wildlife biologist, The Craighead Institute

MEASURE B. HUMAN-GRIZZLY CONFLICTS -OR- GRIZZLY ABUNDANCE

Quality / Indicator: Natural / Plant & Animal Species and Communities

Reason not used: Standardized survey data on grizzly bear populations in the HPBH WSA are not currently available. Given the large ranges of these keystone species and regional influences on patterns of abundance, population assessment at the scale of the HPBH WSA was deemed inappropriate. Furthermore, factors that could influence grizzly bear measures were numerous and varied, making it difficult to discern how a change in these measures would improve or degrade qualities of wilderness character. For example, human-grizzly conflicts would be correlated with bear abundance, volume and patterns in visitor use, and visitor behavior and education on bear awareness. In the future, measures addressing grizzly bear populations and associated human interactions may be implemented.

Possible data source(s): Jodie Canfield, biologist, Gallatin National Forest

MEASURE C. LICHEN COMPOSITION, ABUNDANCE, AND THALLUS CHEMICAL TISSUE ANALYSIS

Quality / Indicator: Natural / Physical resources

Reason not used: There currently are no Forest Inventory Analysis (FIA) database lichen plots within the HPBH WSA. A Montana State University Masters student, Jill Grenon, established lichen study plot locations in the vicinity of the HPBH WSA, but none within the boundary (Leverich Creek, Mt. Ellis, and History Rock). If HPBH plots are established, lichen composition, lichen abundance, and tissue analyses may be monitored and included as biologically diagnostic indicators of air pollution.

Possible data source(s): FIA database; Jill Grenon, Forest Service Region 1 & 4 Air Quality Specialist

MEASURE D. OZONE AIR POLLUTION

Quality / Indicator: Natural / Physical resources

Reason not used: Although recommended as a standard wilderness character measure for Region 1 National Forests by the Wilderness Information Steering Team, this measure was deemed unnecessary given the variety of other air quality measures chosen for implementation.

Possible data source(s): Jill Grenon, Forest Service Region 1 & 4 Air Quality Specialist

MEASURE E. AREA AND MAGNITUDE OF LOSS OF CONNECTIVITY WITH THE SURROUNDING LANDSCAPE -OR- INDEX OF DEVELOPMENT

Quality / Indicator: Natural / Biophysical processes

Reason not used: Relevant data was not available. For future implementation to occur, a concise definition for this measure will be necessary. The measure could monitor fragmentation of forest vegetation, the existence of viable wildlife corridors, the percentage of land privately held within the HPBH vicinity, or other approaches.

Possible data source(s): Montana Natural Heritage Program's landscape integrity model

MEASURE F. CLIMATE CHANGE

Quality / Indicator: Natural / Biophysical processes

Reason not used: Models and standards for assessing localized climate change are not currently available. Should regional or national standards for assessing localized climate change emerge (e.g. long-term trend data from SNOTEL stations), relevant climate change measures will be implemented. Several implemented measures may reflect climate change impacts on the HPBH, including Measure 1-2, 1-3, and 1-4. Ideally, climate change is monitored on a landscape scale larger than the HPBH WSA and trends should be monitored across the larger Greater Yellowstone Ecosystem.

Possible data source(s): SNOTEL stations

MEASURE G. PATHWAYS FOR MOVEMENT OF NON-INDIGENOUS SPECIES INTO THE AREA

Quality / Indicator: Natural / Biophysical processes

Reason not used: Measures were implemented to monitor the number of non-indigenous species in the HPBH WSA, but data was not available to allow for monitoring of the movement pathways that allow non-indigenous species to become established.

Possible data source(s): None identified

MEASURE H. NUMBER OF TRAIL ENCOUNTERS BY LAC OPPORTUNITY CLASS

Quality / Indicator: Solitude / Remoteness from inside

Reason not used: The Gallatin National Forest has not yet developed Limits of Acceptable Change (LAC) opportunity class allocations for the HPBH WSA. Without this zone effort and shared definitions for encounters, there is no accurate way to normalize encounter data. Additional, an encounters monitoring protocol would need to be adapted for the WSA.

Possible data source(s): Future field monitoring by Gallatin National Forest staff or University of Montana citizen scientists

MEASURE I. CAMPSITE DENSITY

Quality / Indicator: Solitude / Remoteness from inside

Reason not used: Lacking LAC or a zoning standard for the WSA, a baseline for the existing density and growth of sites cannot be measured. Lack of time to calculate site density was also a factor for this analysis.

Possible data source(s): Future LAC planning work may establish standards that will define acceptable campsite densities by opportunity class. Historic data could then be analyzed against the new standards. Ongoing campsite monitoring associated with the WSA will provide future data for this measure.

MEASURE J. SOUNDSCAPE INTRUSIONS

Quality / Indicator: Solitude / Remoteness from outside

Reason not used: During the summer of 2011, Wilderness Institute field crews opportunistically monitored the duration and intensity of noise intrusions within the HPBH WSA. The field crews recorded a total of 182 motorized noise intrusions. The majority of recorded noises were from airplanes (89%), with the remaining attributed primarily to vehicles (6%) and helicopters (2%). The opportunistic nature of this data collection precluded any kind of repeatable, standardized survey of auditory intrusions.

There are ongoing efforts to replace the 2011 survey methods with more robust sampling methods, and a new protocol is being piloted by Wilderness Institute crews in 2012. Once a standardized method is established, this measure can be implemented.

Possible data source(s): Noson, A.; Filardi, C. 2011 Field Measures of Wilderness Character: Hyalite Porcupine Buffalo Horn Wilderness Study Area. Wilderness Institute, College of Forestry and Conservation, University of Montana. Missoula, MT; Troy Hall, Professor of Protected Area Visitor Studies, Department of Conservation Social Sciences, College of Natural Resources, University of Idaho and U.S. Forest Service Wilderness Information Steering Committee advisor.

MEASURE K. NUMBER OF ENFORCEMENT ACTIONS

Quality / Indicator: Solitude / Management restrictions on visitor behavior

Reason not used: Data was obtained from the LEMARS database, with associated x, y coordinates. Attempts to screen only those violations or incidents within the WSA boundary proved unreliable. Future data collections must use the NAD83 map projection in order to be consistent.

Possible data source(s): The LEMARS database will continue to be the source for this measure, if more reliable x, y coordinates can be obtained, or a special code added to violation notices and incident reports that occur within the HPBH WSA.

MEASURE L. NUMBER OF ACTIONS TAKEN TO MANIPULATE FISHERIES

Quality / Indicator: Untrammeled / Authorized actions

Reason not used: A separate measure was implemented to monitor lake and other waterbody stocking activities (Measure 3-5). At this time, there are no planned additional fishery manipulations and very few manipulations have occurred historically. If manipulations are increasingly considered or implemented in the future, this measure should be reconsidered.

Possible data source(s): Travis Horton, Montana Fish, Wildlife, and Parks Region 3 Fisheries Program Manager; Bruce Roberts, West Zone Fisheries Biologist, Gallatin National Forest

MEASURE M. NUMBER OF ACTIONS TAKEN TO MANIPULATE WILDLIFE

Quality / Indicator: Untrammeled / Authorized actions

Reason not used: At this time, there are no planned wildlife manipulations and very few manipulations have occurred historically. If manipulations are increasingly considered or implemented in the future, this measure should be reconsidered.

Possible data source(s): Jodie Canfield, Gallatin Forest Biologist; Julie Cunningham, Montana Fish, Wildlife, and Parks Region 3 Biologist

MEASURE N. NUMBER OF UNAUTHORIZED, MISCELLANEOUS TRAMMELING ACTIONS

Quality / Indicator: Untrammeled / Unauthorized actions

Reason not used: Current data sources (i.e. LEMARS) do not allow for isolation of actions that occurred within a specific area, such as the HPBH WSA. Recent queries found issues with x, y coordinate reliability.

Possible data source(s): Law Enforcement and Investigations Management Attainment Reporting System (LEMARS)

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APPENDICES

APPENDIX A: REGION 1 WILDERNESS CHARACTER MONITORING PROTOCOLS

Indicator	Measure	Ongoing Field Data Collection	New Field Data Needed	Data Pull Only	Location of Data	New Data Entry Needed	Staff Responsible for Data	RO or Forest	Frequency
NATURAL QUALITY									
Species and communities	Percentage of wilderness acres with invasive plant species that are not indigenous to the wilderness	X			NRIS (primary) FIA (secondary)	X	Botanist	RO	
	Number of lakes stocked with fish that are not indigenous to the wilderness			X	State Fisheries Agency/Local knowledge		Fisheries Biologist	RO/Forest	
	Subsample sub-watersheds (6th field HUCS) for genetically pure populations of Westslope Cutthroat Trout			X	RMRS PIBO Fish Sampling data (2010-2011) and MFISH		Fisheries Biologist w/Mike Young	RO	Every 10-15 years or opportunistically
	Acres of active grazing allotments with authorized use			X	INFRA		Range Specialist/Data Steward	RO	
	Number of invasive plant species	X			NRIS	X	Botanist	RO	
	Loss of Whitebark Pine (presence and regeneration)	X			FIA Local Data	X	Botanist/ Ecologist	RO/Forest for local data	
Physical resources	Concentration of sulfur in wet deposition	X			NADP	X	Air Quality Specialist	RO	
	Concentration of nitrogen in wet deposition	X			NADP	X	Air Quality Specialist	RO	
	Average sum of anthropogenic fine	X			NADP/VEWS	X	Air Quality	RO	

Indicator	Measure	Ongoing Field Data Collection	New Field Data Needed	Data Pull Only	Location of Data	New Data Entry Needed	Staff Responsible for Data	RO or Forest	Frequency
	nitrate and sulfate						Specialist		
	Average deciview	X			IEWS	X	Air Quality Specialist	RO	
	Lichens	X			RO Databsase	X	Air Quality Specialist	RO	
	Soil disturbance and erosion associated with campsites and trails (barren core)	X			Local Database	X	Wilderness Specialist	Forest	
	Stream water quality	X			PACFISH/INFISH	X	Hydrologist	RO	
Biophysical processes	Departure from natural fire regime (existing vegetation)	X			FIA/LANDFIRE	X	Fuels Specialist	RO	
	Pathways for movement of non-indigenous species into the wilderness	X		X	INFRA (portals) NRIS (weeds)	X	Wilderness/ Botanist	RO	
SOLITUDE QUALITY									
Remoteness from sights and sounds of people inside the wilderness	Acres of wilderness away from access or travel routes ½ mile for roads and motorized trails			X	ROS interface with topography		Wilderness Specialist/ Landscape Architect	RO	
	Number of parties visiting a wilderness during the primary use season	X			Local Database	X	Wilderness Specialist	Forest	
	NVUM annual wilderness visits	X			NVUM	X	NVUM Coordinator	RO	
	Campsite Density	X			Local Database	X	Wilderness Specialist	RO	
	Trail Encounters	X			Local Database	X	Wilderness Specialist	RO	

Indicator	Measure	Ongoing Field Data Collection	New Field Data Needed	Data Pull Only	Location of Data	New Data Entry Needed	Staff Responsible for Data	RO or Forest	Frequency
	Degraded Soundscape—time when quiet is affected by unnatural sounds (airplanes, jet boats)		X		Local Database	X	Wilderness Specialist	Forest	
Facilities that decrease self-reliant recreation	Index of recreation facilities (number and type)			X	INFRA		Recreation Specialist	RO/Forest	
	Index of unauthorized recreation facilities	X		X	LEMARS		Wilderness Specialist/Law Enforcement	Forest	
	Number of trail miles in developed condition classes 3 to 5			X	INFRA		Trails Specialist	RO	
	Outfitters and guides assigned sites	X			SUDS	X	Wilderness Specialist	Forest	
Management restrictions on visitor behavior	Index of restrictions on visitor behavior(regulations)			X	INFRA		Wilderness Specialist	Forest	
	Number of enforcement actions	X			LEMARS	X	Wilderness Specialist/Law Enforcement	Forest	

Indicator	Measure	Ongoing Field Data Collection	New Field Data Needed	Data Pull Only	Location of Data	New Data Entry Needed	Staff Responsible for Data	RO or Forest	Frequency
UNTRAMMELED QUALITY									
Actions authorized by the Federal land manager that manipulate biophysical environment	Vegetation management	X		X	FACTS	X	Botanist	RO	
	Fisheries management	X			State Fisheries and Wildlife Agency/Local Knowledge	X	Fisheries biologist	RO/Forest	
	Wildlife management	X			State Agencies	X	Wildlife biologist	RO	
	Acres burned with prescribed fire	X			FACTS	X	Fuels Specialist	RO/Forest	
	Number of natural fire starts that received a suppression response	X			Local Database	X	Fire Management Officer	Forest	
	Number of natural fire starts that are suppressed	X			Local Database	X	Fire Management Officer	Forest	
	Number of natural starts with on-ground management actions	X			Local Database	X	Fire Management Officer	Forest	
	Number of lakes and other water bodies stocked with native fish in waters that were naturally fishless			X	Information may not be available, still investigating		Fisheries Biologist	RO/Forest	

Indicator	Measure	Ongoing Field Data Collection	New Field Data Needed	Data Pull Only	Location of Data	New Data Entry Needed	Staff Responsible for Data	RO or Forest	Frequency
Actions not authorized by the Federal land manager that manipulate the biophysical environment	Number of unauthorized actions	X			LEMARS	X	Wilderness Specialist/law enforcement	RO/Forest	
UNDEVELOPED QUALITY									
Non-recreational structures, installations, and developments	Index of authorized physical developments (includes administrative buildings, dams, roads, structures associated with special provisions)			X	INFRA		Wilderness Specialist	RO/Forest	
	Unauthorized development	X			LEMARS	X	Wilderness Specialist/Law enforcement	RO/Forest	

Indicator	Measure	Ongoing Field Data Collection	New Field Data Needed	Data Pull Only	Location of Data	New Data Entry Needed	Staff Responsible for Data	RO or Forest	Frequency
Use of motorized equipment/mechanical transport	Authorized use	X				X	Wilderness Specialist	RO/Forest	
	Unauthorized use	X				X	Wilderness Specialist/Law enforcement	RO/Forest	

Wilderness-specific measures to consider:

Structures—dams, corrals, etc.

Degraded Soundscape—time when quiet is affected by unnatural sounds (airplanes, jet boats)

Definitions:

Ongoing field data collection—These are items that are either already being collected or will be collected opportunistically. For instance information on campsites and visitor encounters is collected by wilderness rangers every season. This data will continue to be collected and will require new data entry. Measures such as unauthorized motorized equipment or mechanical transport is collected and input as it occurs. This requires no additional work beyond what is already being completed.

New field data needed—This is a measure that requires new data to be collected that is currently not being collected or has never been collected. This will require new work.

Data pull only—These are items that are unchanging, data exists and will only require a data pull. An example of this is miles of trail. This will require a data pull but the data already exists.

New data entry necessary—Data entry is required when data is collected but for items that are already being monitored. This is ongoing work that is already being done.

APPENDIX B: CAMPSITE CONDITION EVALUATION WORKSHEET

Wilderness Campsite Inventory & Condition Evaluation (TLWSA 2010)

Date Evaluated: _____

Evaluated by: _____

Objectives:

1. Find out how many and where the campsites are
2. Create a GPS waypoint for each site
3. Evaluate changing campsite conditions (trend) over time
4. Photo record each site

PART 1: General Site Description

1. SITE NUMBER (Tr. #-campsite #): _____
2. Lat/Long _____
3. Elevation _____
4. DISTANCE TO CONSTRUCTED TRAIL: <200 ft **OR** >200ft
5. DISTANCE TO WATER: <200ft **OR** >200ft
6. DISTANCE TO CLOSEST CAMPSITE: <500ft **OR** >500ft
7. TWO PHOTOS from photo points that best describe the site. Note the compass bearing from the center of camp to the photo point for future replication.

PART 2: Wilderness Challenge Survey

A. Evaluate disturbance to **ground cover of core camp only!**

Choose one:

- 1....flattened vegetation but still alive, minimal physical change
- 2....vegetation worn away around center of activity
- 3....vegetation lost on most of site, but humus and litter still present
- 4....bare mineral soil widespread over most of site

B. Evaluate severe damage to trees at site. A severely damaged tree has one of the following:

- been felled and is at least 4 inches in diameter
- scarring that exceeds 1 square foot in total area
- highly exposed roots totaling three linear feet

Choose one:

- 0....0-5 severely damaged trees
- 1....6-10 severely damaged trees
- 2....>10 severely damaged trees

C. Quantify **total disturbed area** for site, adding satellite areas to core area:

Choose one:

- 0....Sum of disturbed areas equals 0 – 250 ft square
- 1....Sum of disturbed areas equals 251 – 1000 ft square
- 2....Sum of disturbed areas is greater than 1000 ft square

PART 3: Impact Evaluation

1. VEGETATIVE COVER:

ON CAMPSITE 1 – 0-5% 2 – 6-25% 3 – 26-50% 4 – 51-75% 5 – 76-100%

ON UNUSED COMPARATIVE AREA 1 – 0-5% 2 – 6-25% 3 – 26-50% 4 – 51-75% 5 – 76-100%

2. MINERAL SOIL EXPOSURE

ON CAMPSITE 1 – 0-5% 2 – 6-25% 3 – 26-50% 4 – 51-75% 5 – 76-100%

ON UNUSED COMPARATIVE AREA 1 – 0-5% 2 – 6-25% 3 – 26-50% 4 – 51-75% 5 – 76-100%

Rating (Circle one category)

3. VEGETATIVE LOSS

1 (No difference in cover class) **2** (Difference of one cover class) **3** (Difference of two or more coverage classes)

SCORE WEIGHT TOTAL x2

4. MINERAL SOIL EXPOSURE

1 (No difference in cover class) **2** (Difference of one cover class) **3** (Difference of two or more coverage classes)

SCORE WEIGHT TOTAL x3

5. TREE DAMAGE # of trees damaged _____

1 (No more than broken lower branches) **2** (1-8 scarred trees, or 1-3 badly scarred or felled) **3** (> 8 scarred trees, or >3 badly scarred or felled) **SCORE WEIGHT TOTAL x2**

6. ROOT EXPOSURE # of trees with exposed roots _____

1 (None) **2** (1-6 trees with roots exposed) **3** (> 6 trees with roots exposed) **SCORE WEIGHT TOTAL x3**

7. DEVELOPMENT

1 (None) **2** (1 fire ring with or without primitive log seat) **3** (> 1 fire ring or other major development) **SCORE**

WEIGHT TOTAL x1

8. CLEANLINESS No. of fire scars _____

1 (No more than scattered charcoal from 1 fire ring) **2** (Remnants of > 1 fire ring, some litter or manure) **3** (Human waste, much litter or manure) **SCORE WEIGHT TOTAL x1**

9. SOCIAL TRAILS No. of trails _____

1 (No more than 1 discernable trail) **2** (2-3 discernable, max. 1 well-worn) **3** (> 3 discernable or more than 1 well worn) **SCORE WEIGHT TOTAL x2**

10. CAMP AREA Estimated camp area _____

1 (< 500 ft square) **2** (500-2000 ft square) **3** (> 2000 ft square) **SCORE WEIGHT TOTAL x4**

11. BARREN CORE CAMP AREA Estimated camp area _____

1 (< 50 ft square) **2** (50 – 500 ft square) **3** (> 500 ft square) **SCORE WEIGHT TOTAL x2**

IMPACT INDEX _____

*Impact index scores: <23 = minimum, 24 to 34 = moderate, 35 to 45 = high, >45 = extreme

Order Number: 12-11-00-01

**GALLATIN NATIONAL FOREST
10 East Babcock Ave.
P.O. Box 130, Federal Building
Bozeman, MT 59771
Forest Supervisor's Special Order**

Pursuant to 36 Code of Federal Regulations 261.50 (a) & (b) the following restrictions are in effect on the Gallatin National Forest. These restrictions are in addition to those enumerated in Subpart A, Part 261, Title 36 Code of Federal Regulations, and become effective when signed and will remain in effect for one year and may be reissued.

36 CFR 261.56 – Use of Vehicles Off National Forest System Roads:

When provided by an order, it is prohibited to possess or use a vehicle off National Forest System roads. [36 CFR 261.56]

For the purposes of this order, it is prohibited to use or possess any motor vehicle (including but not limited to motorcycles, ATVs, 4x4 vehicles) or bicycle in the Hyalite Porcupine Buffalo Horn (HPBH) Wilderness Study Area (WSA) (as described by Public Law 95-150) and displayed on the attached map exhibit. Use or possession of these vehicles is prohibited yearlong, except on roads or trails that are specifically designated as open during specific time periods as listed below. See the map exhibit attached to this order.

36 CFR 261.55 – Forest Development Trails:

Using any type of vehicle prohibited by the order. [36 CFR 261.55 (b)]

For the purposes of this order, it is prohibited to use or possess any motor vehicle (including but not limited to motorcycles, ATVs, 4x4 vehicle) or bicycle off of a designated open trail within the HPBH WSA. Use or possession of these vehicles is prohibited yearlong, except on trails that are specifically designated as open during specific time periods as listed below. See the map exhibit attached to this order.

Bicycles:

- A. The following trails are **designated as open** to bicycles year long. Bicycles must stay on the designated open trail, cross country travel is prohibited. Designated open trails include: West Pine #139; North Dry Divide #135 from the trailhead in T. 4 S. R.8E. Sec. 30 northwest approximately two miles to the junction with the West Pine Trail #139 in the northwest quarter of Section 24; Donahue #183, Blackmore #423; South Cottonwood #422; History Rock # 424; Storm Castle Ridge #417; Twin Cabin #46; First Cutoff Creek #466; Hidden Lakes Cutoff #194; Hidden Lakes #179; Hidden Lake Divide #66; Storm Castle #185, Porcupine #199.

- B. The following trails are **designated as open** to bicycles from June 16 through March 31: Porcupine Creek #34 and Buffalo Horn #1. Bicycles are prohibited seasonally on these trails between April 1 – June 15 to protect the trail resource. Bicycles must stay on designated open trails, cross country travel is prohibited.
- C. The following trails are **designated as open to bicycles** yearlong, except that bicycles are prohibited on specific days from July 16 to September 4 (also see Gallatin NF Order # 08-11-00-01) Bicycles must stay on the following designated trails, cross country travel is prohibited:
- a. The East Fork of Hyalite Trail #434 is designated as open to bicycles only on Tuesday, Wednesday, Thursday, Friday and Saturday from July 16th – September 4th. Bicycles are prohibited on the East Fork Hyalite Trail #434 on Sunday and Monday between July 16th and September 4th.
 - b. The Hyalite Trail #427 is designated as open to bicycles only on Sunday, Monday, Tuesday, Wednesday, and Thursday from July 16 – September 4. Bicycles are prohibited on the Hyalite Trail on Friday and Saturday from July 16 – September 4. This trail is designated as open to bicycling from the trailhead in T.5S., R.6E., Sec. 34 south to the junction with the Storm Castle Trail #185 in the northwest quarter of Sec. 23, T.5S., R.6E. only. Bicycles are prohibited yearlong on the Hyalite Trail #434 south of this junction. See the map exhibit attached.

Bicycles are defined as a vehicle with two wheels in tandem, propelled by foot pedals, and having handlebars for steering.

Motorcycles:

- A. The following trails are **designated as open to motorcycles** from July 16 – September 4. Motorcycles must stay on the designated open trail, cross country travel is prohibited. See the attached map exhibit
- a. Buffalo Horn #1; Porcupine #199; Porcupine Creek #34; Ramshorn Lake #160; First Cutoff Trail #466; Hidden Lakes Divide #66; Hidden Lakes Cutoff # 194; Hidden Lakes 179; and Storm Castle Creek #185.
- B. The following trails are **designated as open to motorcycles** from July 16 – September 4, except on specific days noted below:
- a. The East Fork of Hyalite Trail #434 is designated as open to motorcycles only on Wednesday, Thursday, Friday and Saturday from July 16th – September 4th. Motorcycles are prohibited on the East Fork Hyalite Trail #434 on Sunday, Monday and Tuesday between July 16th and September 4th.
 - b. The Hyalite Trail #427 is designated as open to motorcycles only on Sunday, Monday, Tuesday, Wednesday, and Thursday from July 16 – September 4. Motorcycles are prohibited on the Hyalite Trail on Friday and Saturday from July 16 – September 4. This trail is designated as open to motorcycling from the trailhead in T.5S., R.6E., Sec. 34 south to the junction with the Storm Castle Trail #185 in the northwest quarter of Sec. 23, T.5s., R.6E. only. Motorcycles are prohibited yearlong on the Hyalite Trail #434 south of this junction. See the map exhibit attached.

Motorcycles are defined as a two-wheeled motor vehicle 50 inches or less in width on which two wheels are not side-by-side but in-line with the direction of travel.

These temporary restrictions are necessary to comply with a court ordered injunction for the HPBH Wilderness Study Area.

Exemptions:

Pursuant to 36 CFR 261.50(e), the following persons are exempt from this order:

1. Persons with a permit specifically authorizing the otherwise prohibited act or omission.
2. Any Federal, State, or local officer, or member of an organized rescue or firefighting force in the performance of an official duty.

Done at Bozeman, Montana this 15th day of May, 2012.

/s/ Mary C Erickson
MARY C. ERICKSON
Forest Supervisor
Gallatin National Forest

Penalty: Violations of these Prohibitions are punishable by a fine of not more than \$5,000 for an individual or \$10,000 for an organization, or imprisonment for not more than six months, or both. [16 USC 551 and 18 USC 3559 and 3571].

Notification: A copy of this order shall be posted as prescribed under 36 CFR 261.51.

Order Number: 11-11-00-03

**GALLATIN NATIONAL FOREST
10 East Babcock Ave.
P.O. Box 130, Federal Building
Bozeman, MT 59771
Forest Supervisor's Special Order**

Pursuant to 36 Code of Federal Regulations 261.50 (a) & (b) the following restrictions are in effect on the Gallatin National Forest. These restrictions are in addition to those enumerated in Subpart A, Part 261, Title 36 Code of Federal Regulations, and become effective when signed and will remain in effect for one year and may be reissued.

36 CFR 261.56 – Use of Vehicles Off National Forest System Roads:

When provided by an order, it is prohibited to possess or use a vehicle off National Forest System roads. [36 CFR 261.56]

For the purposes of this order, it is prohibited to use or possess snowmobiles, tracked ATVs, or other over-snow vehicles; this use is **prohibited yearlong** in the Hyalite Porcupine Buffalo Horn (HPBH) Wilderness Study Area as (described by Public Law 95-150), **except** snowmobiles are allowed in a small open area in the Golden Trout Lakes Basin and west of Windy Pass (see the attached map exhibit) from December 2 – April 15.

36 CFR 261.55 – Forest Development Trails:

Using any type of vehicle prohibited by the order. [36 CFR 261.55 (b)]

For the purposes of this order, relative to the Big Sky Snowmobile Trail #900 and open area as designated on-the-ground and displayed on the attached map; **snowmobiles are permitted to use the Big Sky Snowmobile Trail on the designated route only from December 2 – April 15**; it is prohibited to use or possess tracked ATVs, or any other over-snow vehicle on the trail. Snowmobiles are limited to the designated route, and must stay within 300' of either side of the marked trail. A snowmobile is defined as a motorized vehicle 50 inches or less in width designed for use over snow, runs on a single track, and uses one or more skis for steering. This closure area and designated snowmobile trail are also displayed with the Gallatin National Forest 2011/2012 Over Snow Vehicle Use Map.

Exemptions:

Pursuant to 36 CFR 261.50(e), the following persons are exempt from this order:

1. Persons with a permit specifically authorizing the otherwise prohibited act or omission.
2. Any Federal, State, or local officer, or member of an organized rescue or firefighting force in the performance of an official duty.

Done at Bozeman, Montana this 7th day of November, 2011.

/s/ Mary C Erickson
MARY C. ERICKSON
Forest Supervisor
Gallatin National Forest

Penalty: Violations of these Prohibitions are punishable by a fine of not more than \$5,000 for an individual or \$10,000 for an organization, or imprisonment for not more than six months, or both. [16 USC 551 and 18 USC 3559 and 3571].

Notification: A copy of this order shall be posted as prescribed under 36 CFR 261.51.